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Dooley et al.

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(54) **SYSTEM AND METHOD FOR EXTRACTING AND SEPARATING BOTANICAL OILS WITHOUT THE USE OF SOLVENTS**

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May 30, 2018 (CA) 3006692

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B01D 11/02 (2006.01)
B03C 3/017 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***B01D 11/0211*** (2013.01); ***B01D 11/0207*** (2013.01); ***B01D 11/028*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC B03C 3/15; B03C 3/10
See application file for complete search history.

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(57) **ABSTRACT**

A system and method for extracting and separating botanical oils and compounds from botanical material without the use of solvents, having a vaporizing section which is further coupled to a centrifugal electrostatic precipitator for collection and segregation. The vaporizing section receives the botanical material through which a temperature-controlled inert gas is passed to evaporate specific vaporization temperature oils or compounds from the botanical material. The extracted vapor passes to the centrifugal electrostatic precipitator where the oil or compound is reduced back to the liquid state and is collected and segregated. The oils having the lower vapor temperature are collected first and the remaining oils are collected by specific and progressive vaporization temperature control. In some examples,

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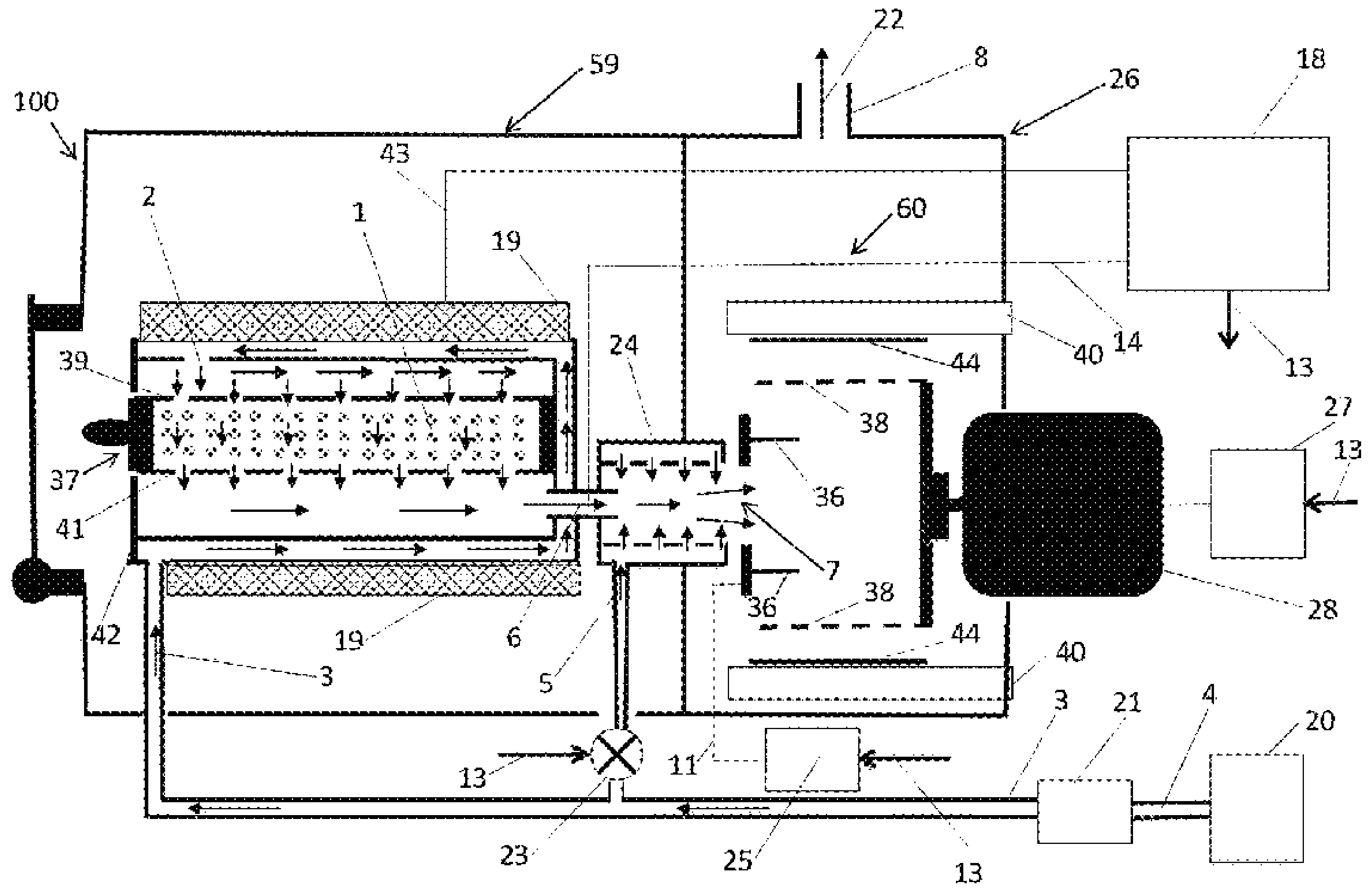

selected vaporized compounds are waste exhausted as vapor by bypassing the centrifugal electrostatic precipitator at specific known vapor temperatures, thereby eliminating potentially toxic or undesirable oils or compounds from being collected.

53 Claims, 16 Drawing Sheets

(51) **Int. Cl.**

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B03C 3/41	(2006.01)
B03C 3/49	(2006.01)
C07D 311/80	(2006.01)
B01D 11/00	(2006.01)

(52) **U.S. Cl.**

CPC ***B03C 3/017*** (2013.01); ***B03C 3/10*** (2013.01); ***B03C 3/15*** (2013.01); ***B03C 3/38*** (2013.01); ***B03C 3/41*** (2013.01); ***B03C 3/49*** (2013.01); ***C07D 311/80*** (2013.01); *B01D 2011/007* (2013.01)

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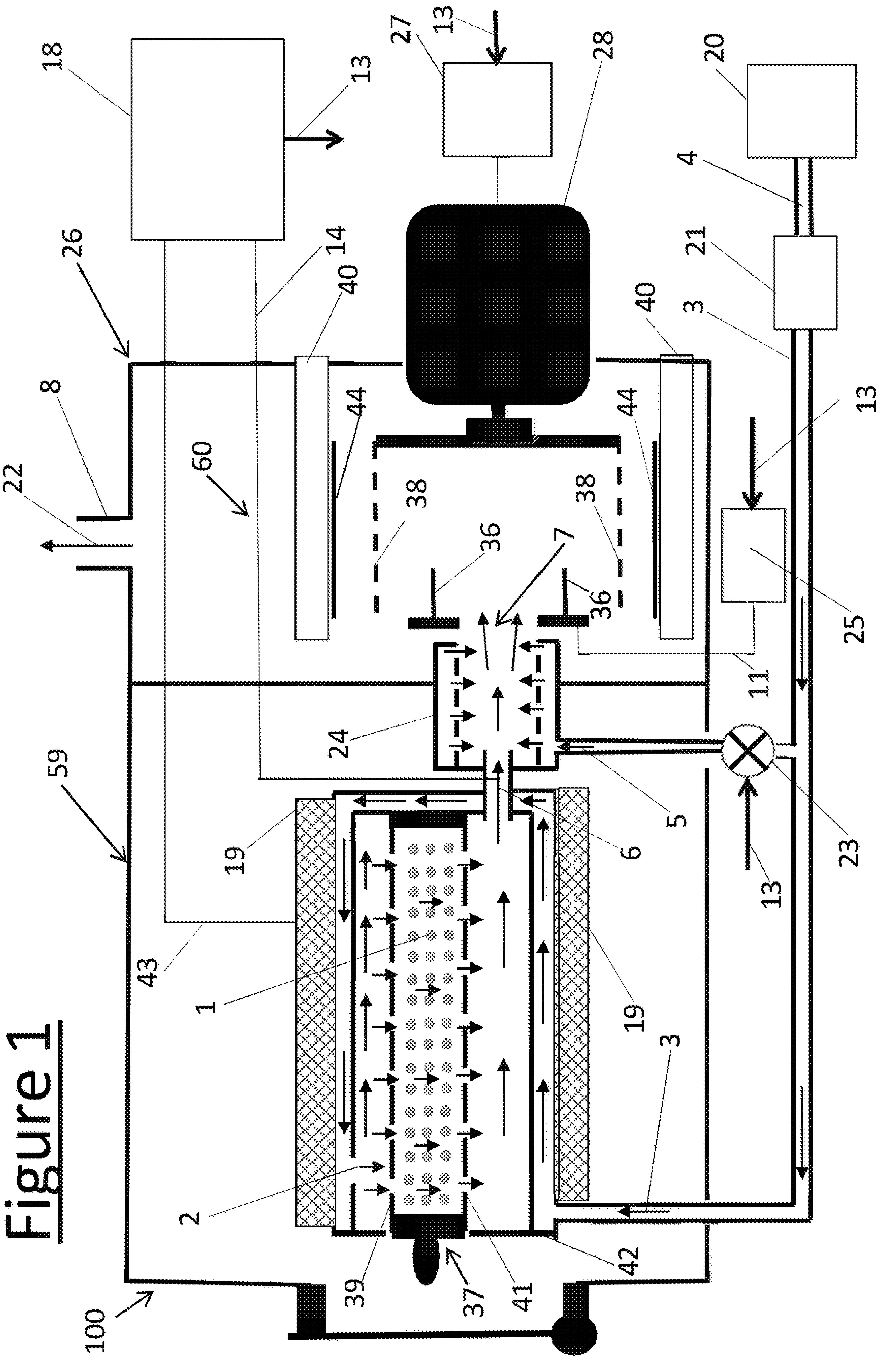
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Figure 1

Figure 2

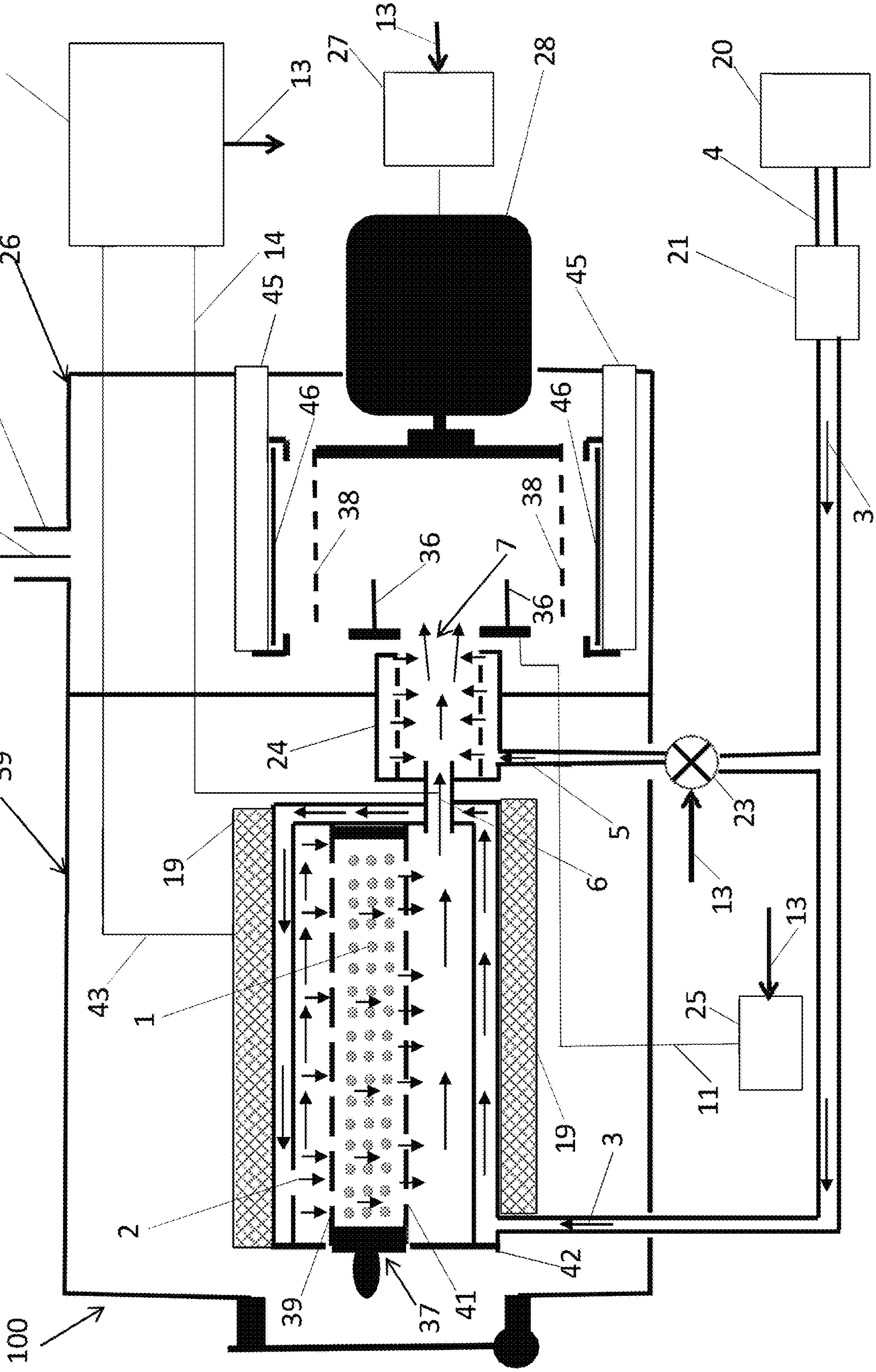
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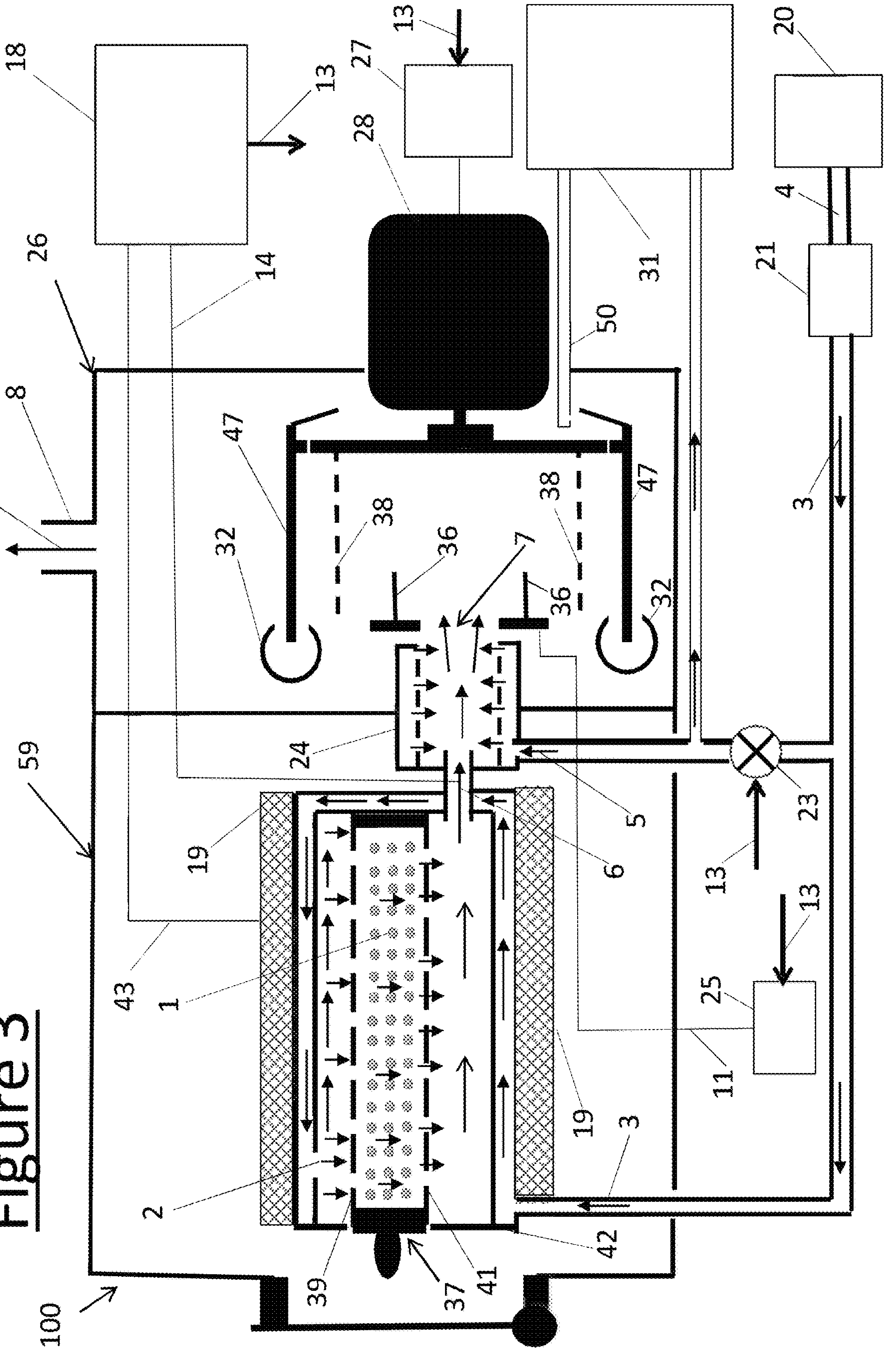
Figure 3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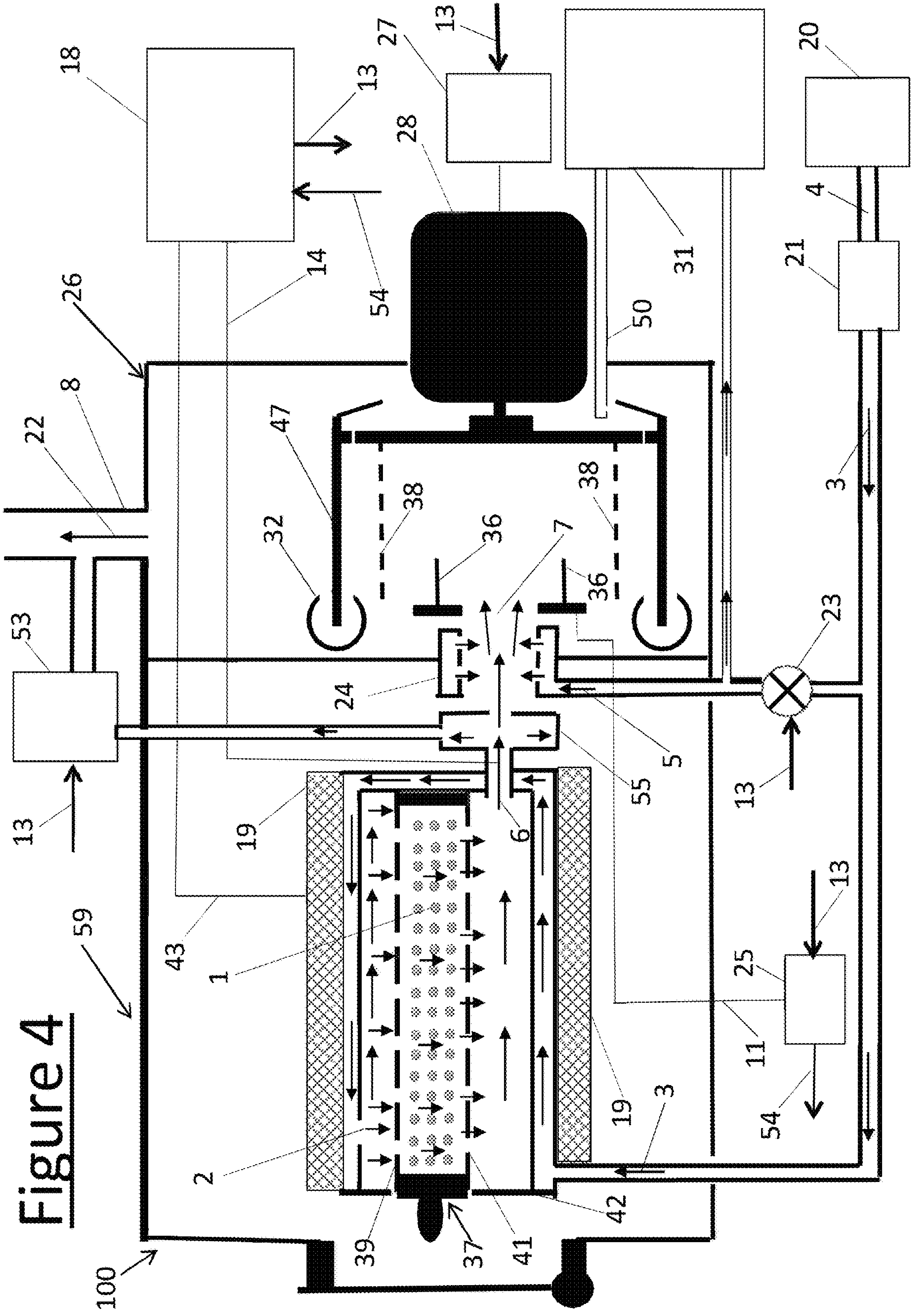
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Figure 4

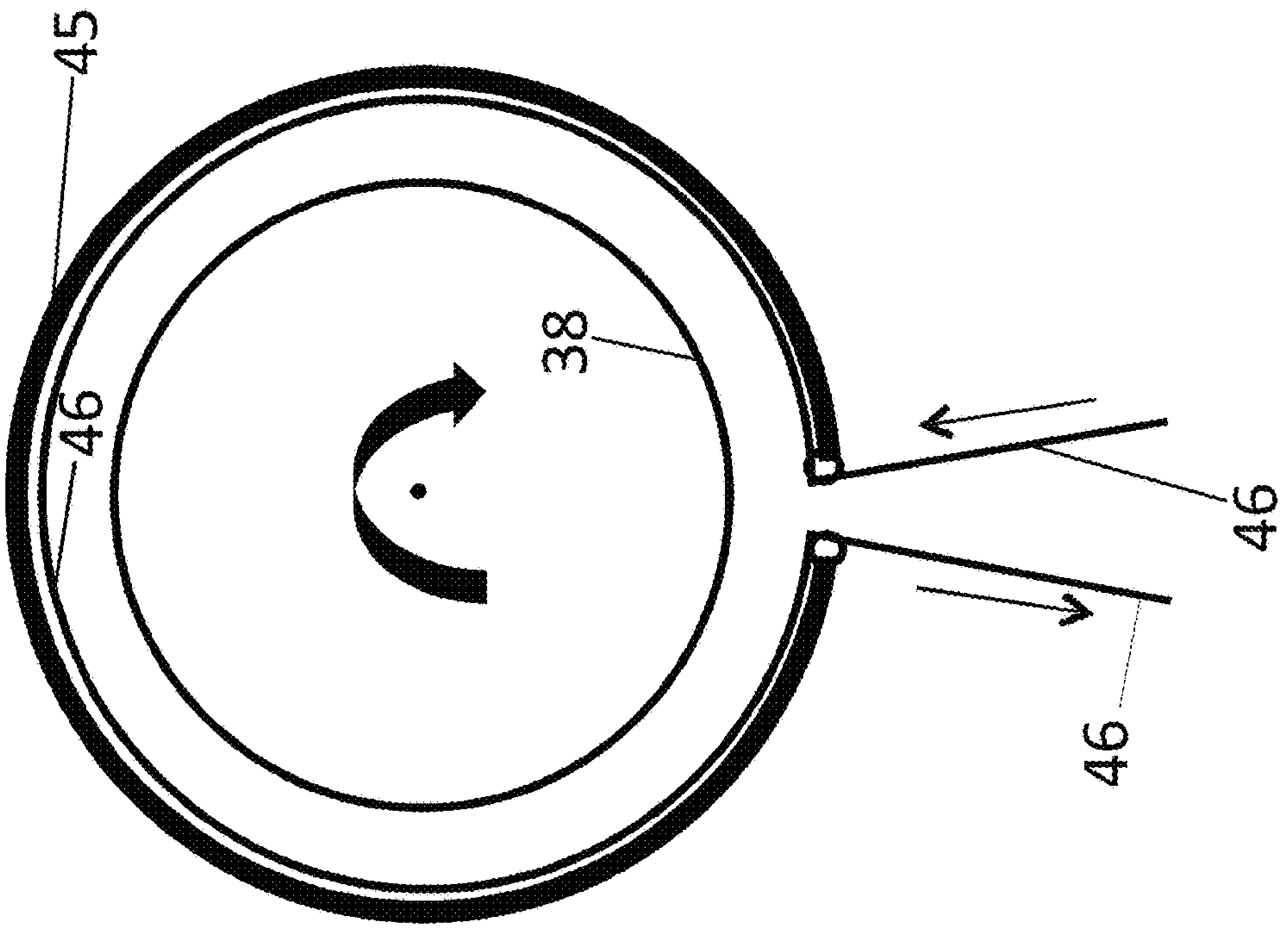


Figure 5

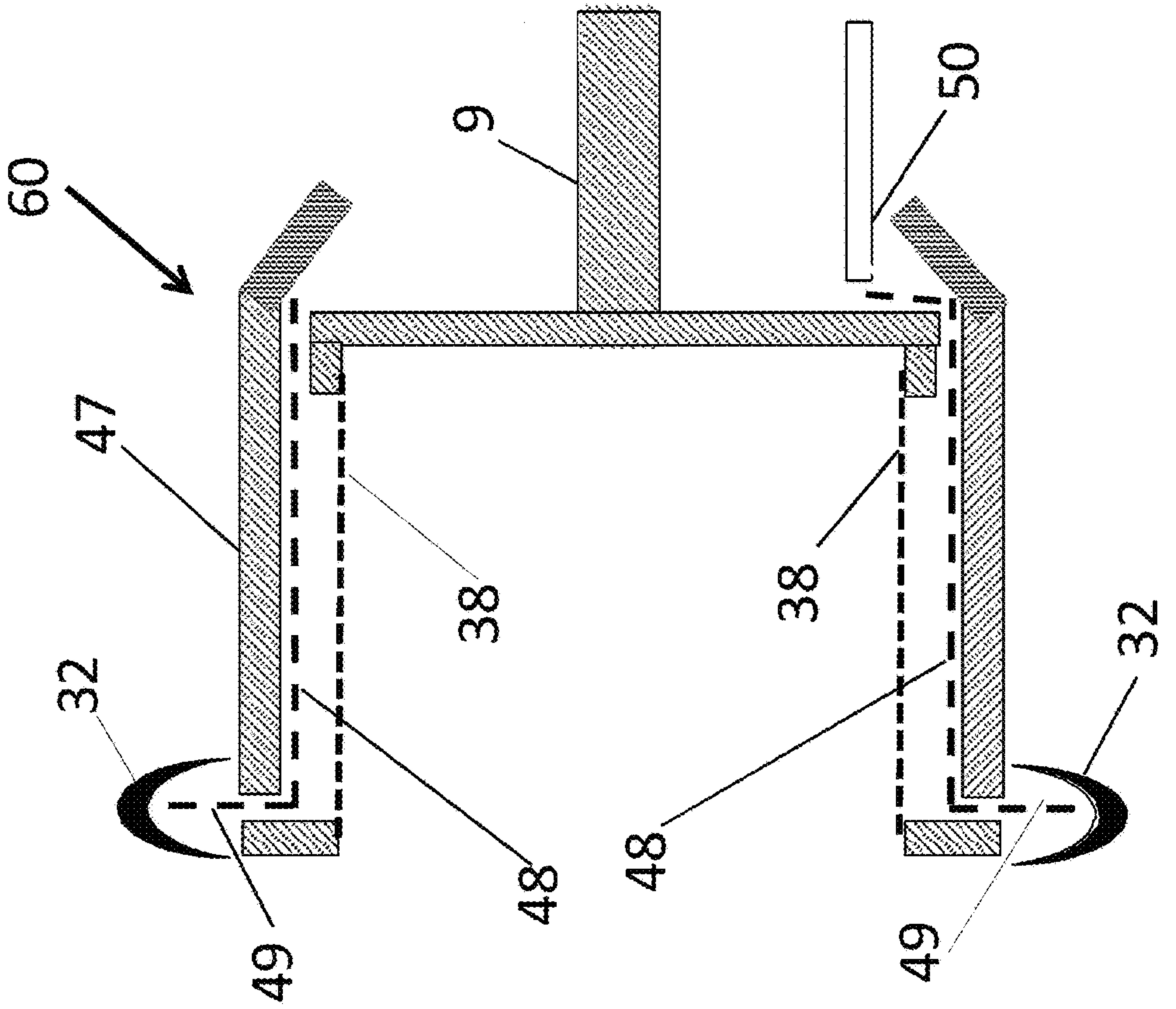
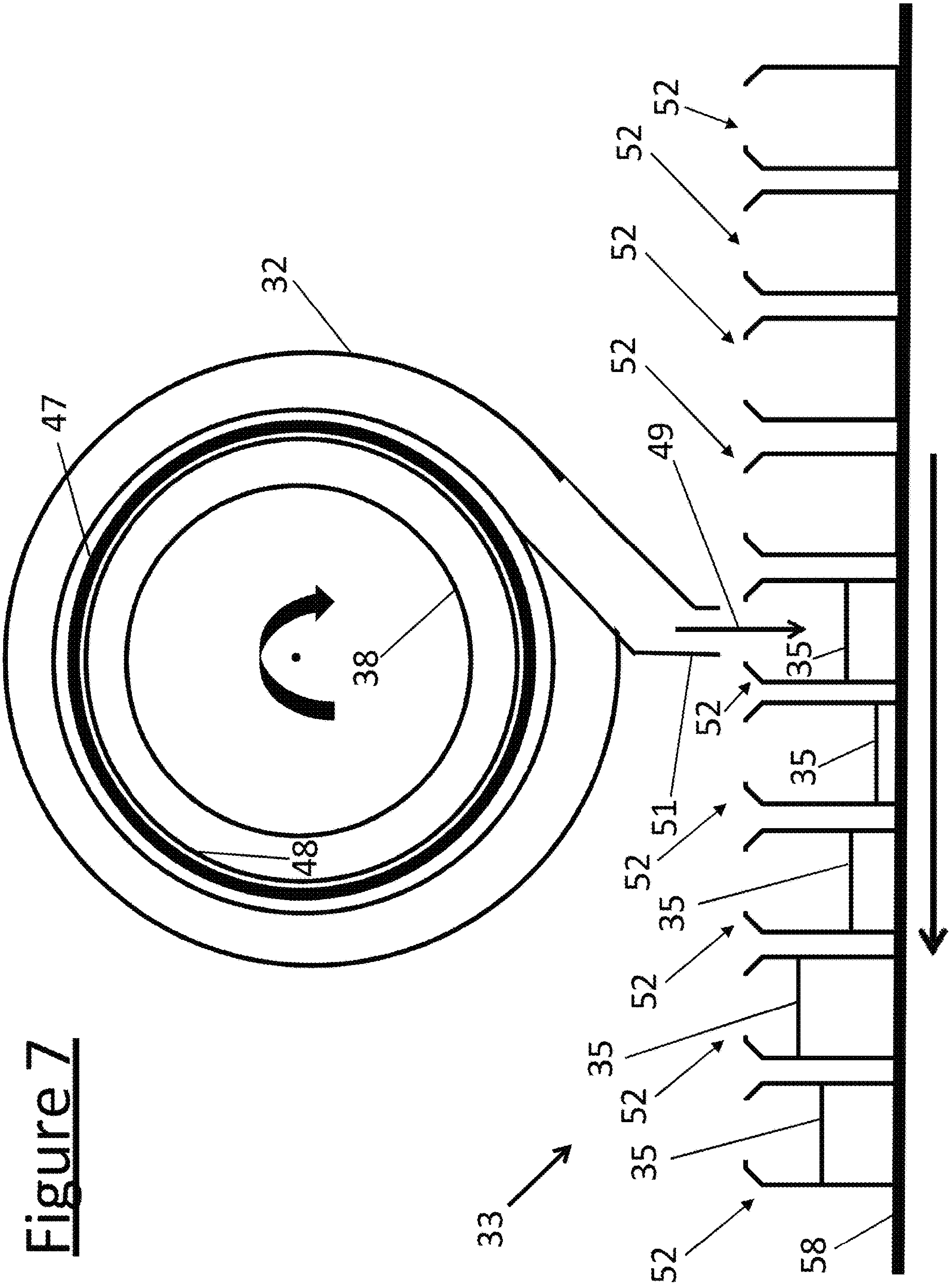


Figure 6

Figure 7



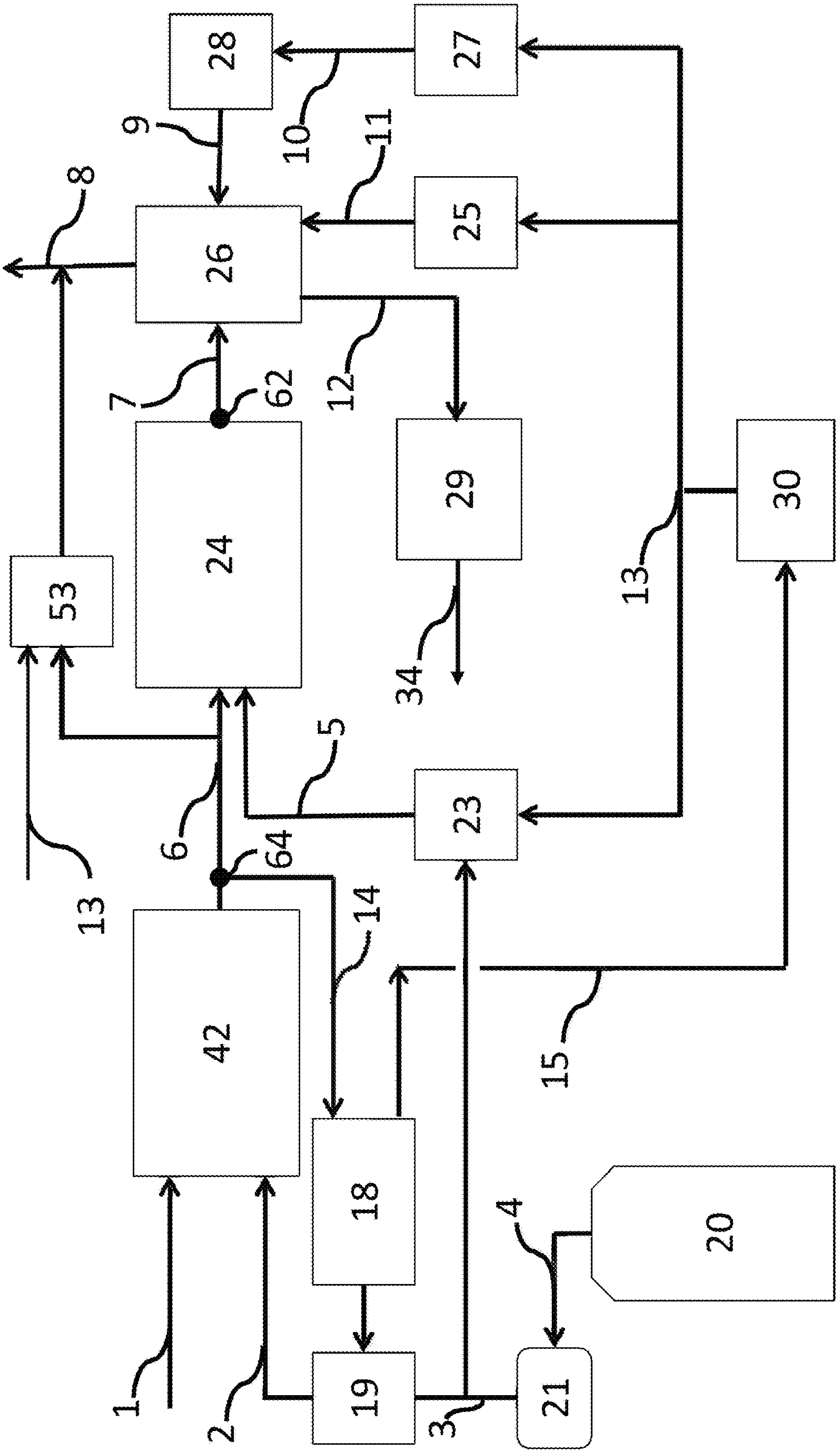

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Figure 8

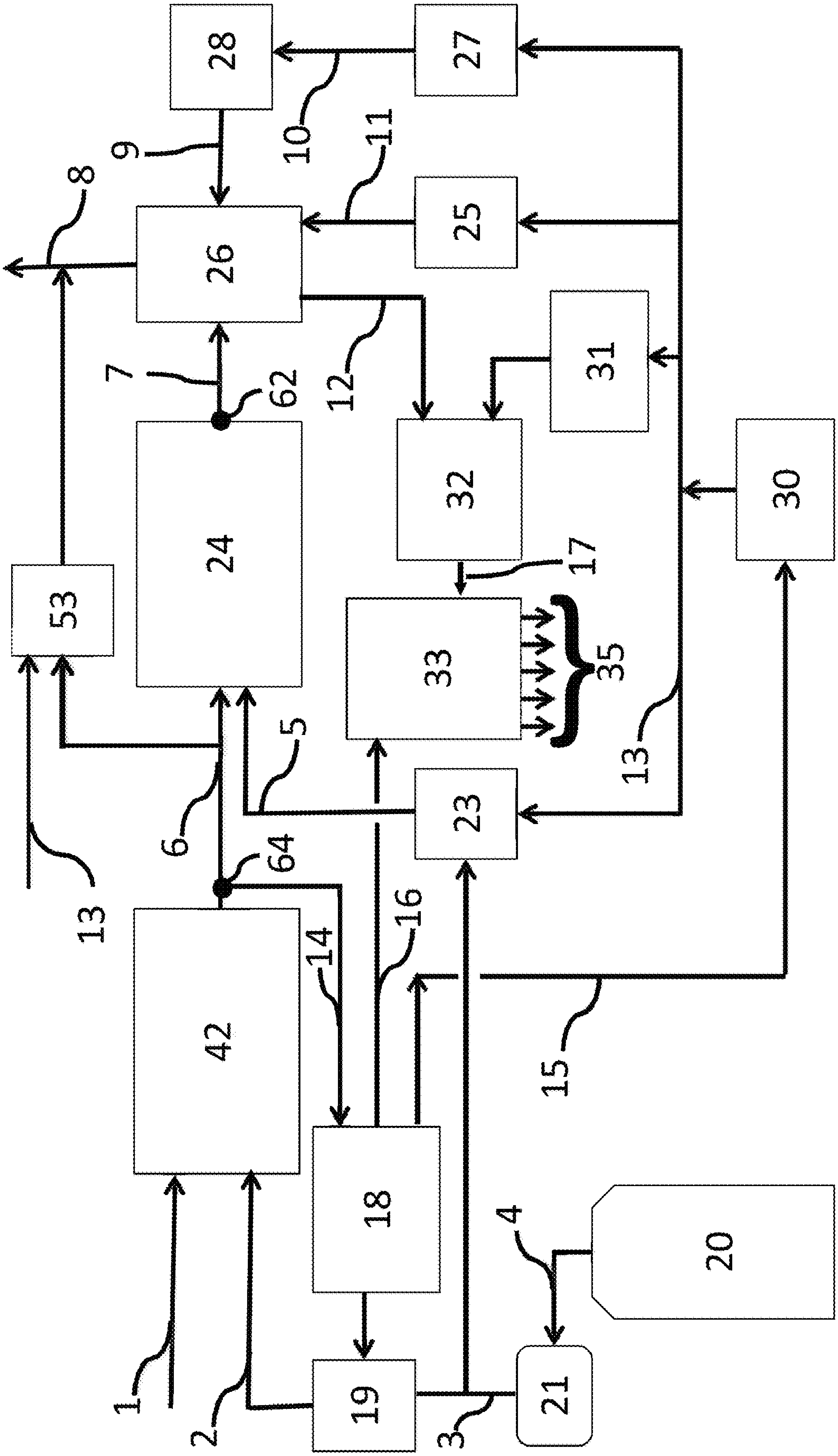
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Figure 9

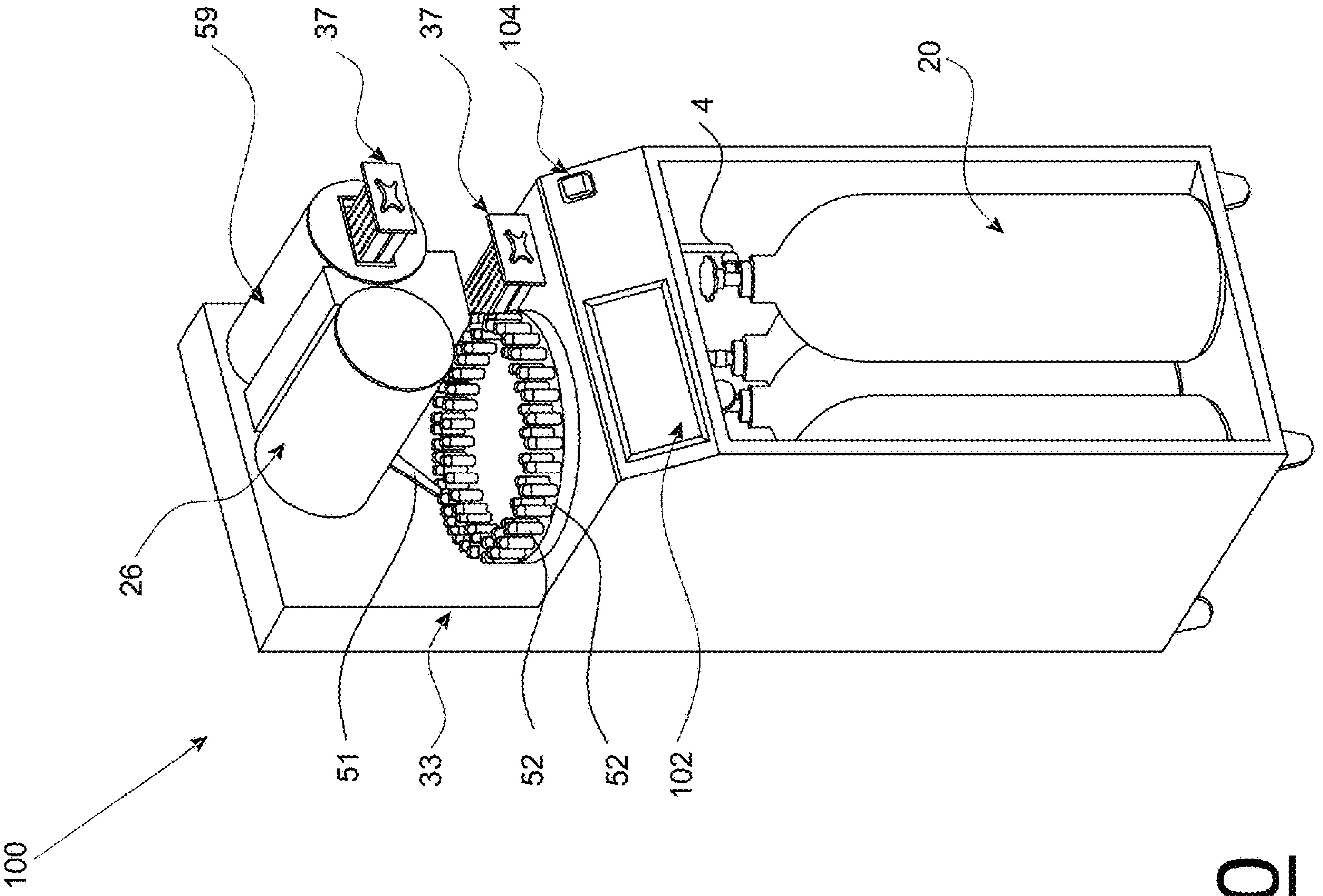
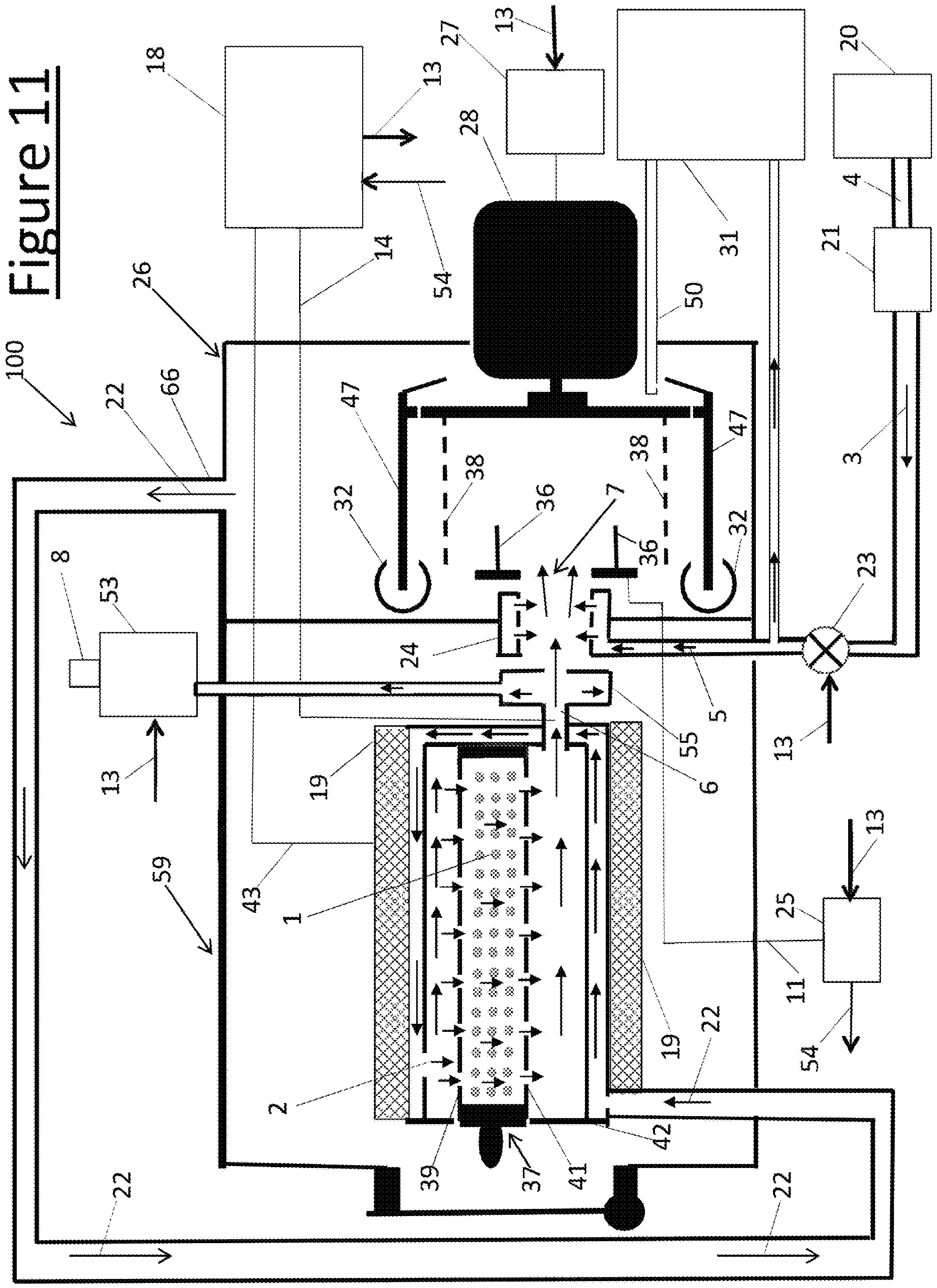


Figure 10

Figure 11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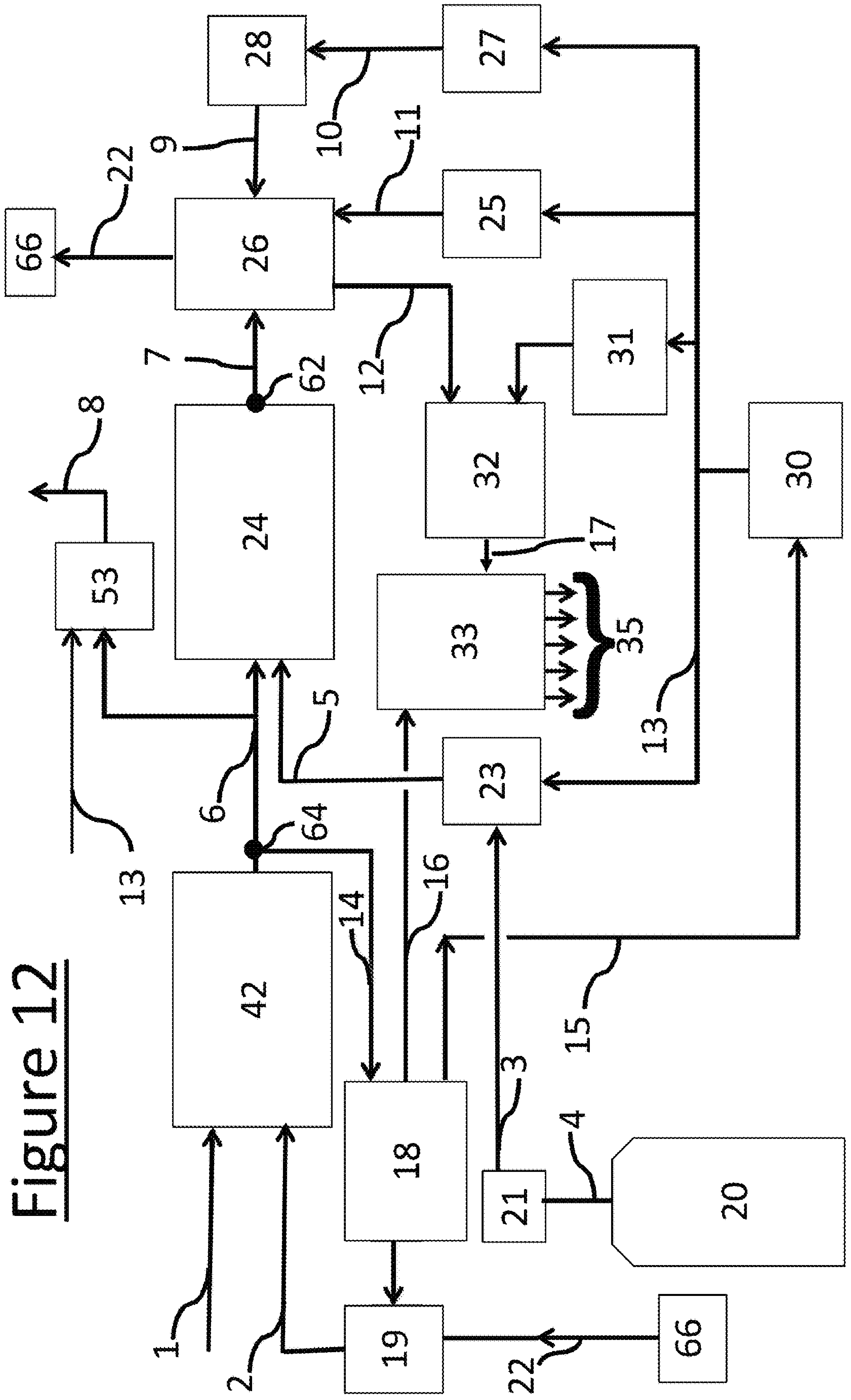
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Figure 12

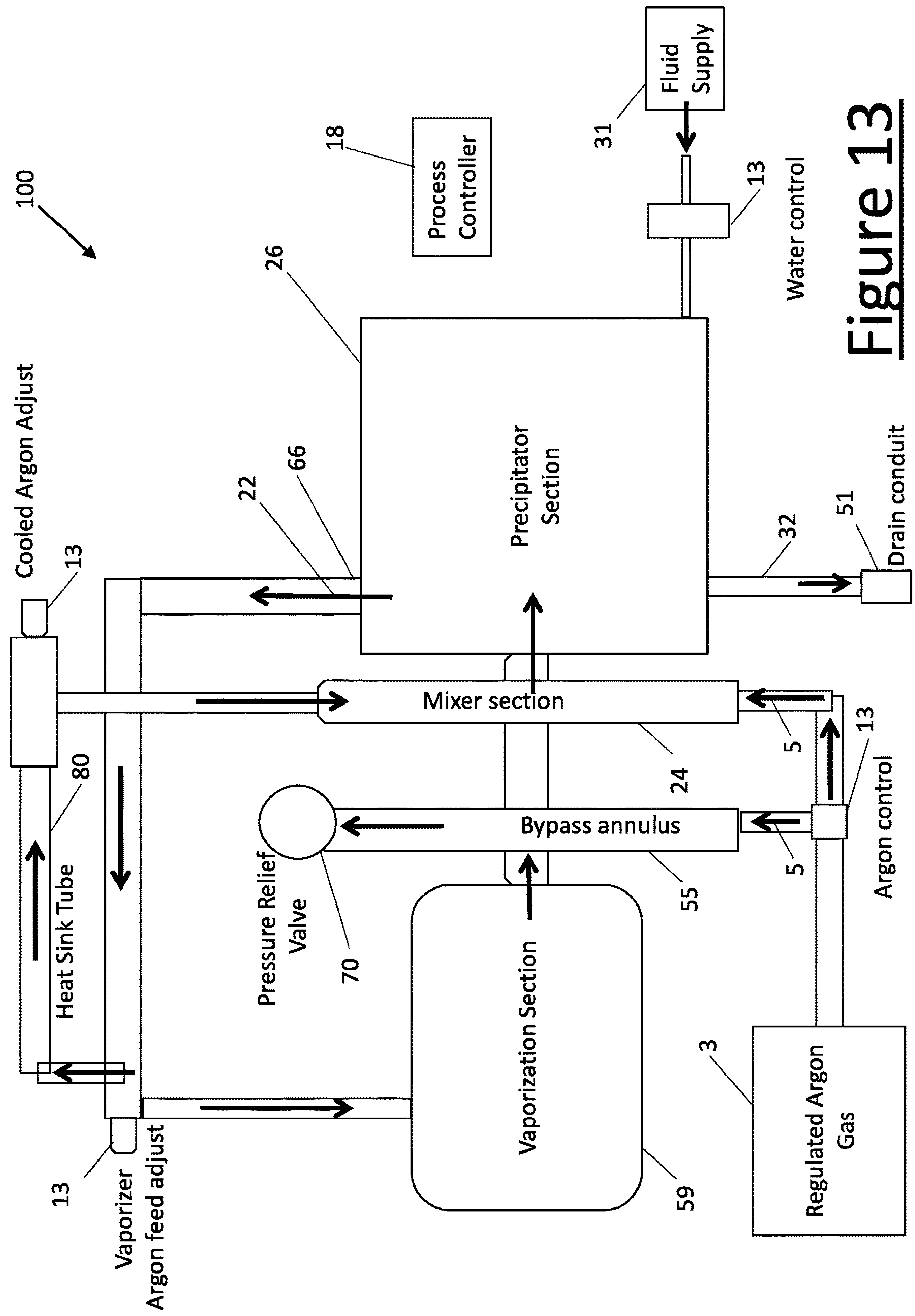
100
Cooled Argon Adjust
13
Heat Sink Tube
80
Vaporizer
Argon feed adjust
13
22
66
26
18
Process
Controller
Fluid
Supply
31
13
Water control
Precipitator
Section
32
51
Drain conduit
Mixer section
24
5
13
Argon control
Bypass annulus
5
55
Pressure Relief
Valve
70
Vaporization Section
59
3
Regulated Argon
Gas

Figure 13

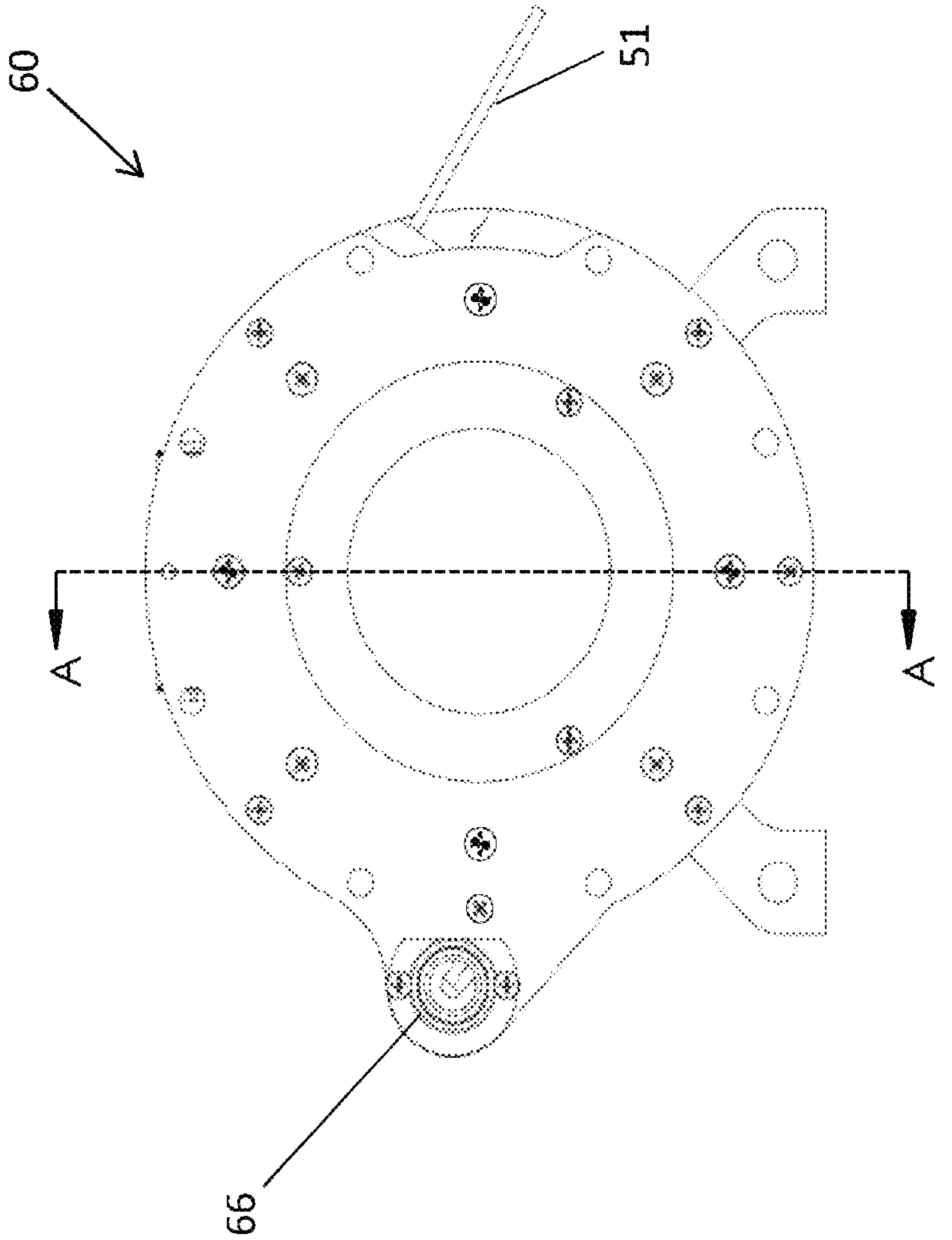

Figure 14A

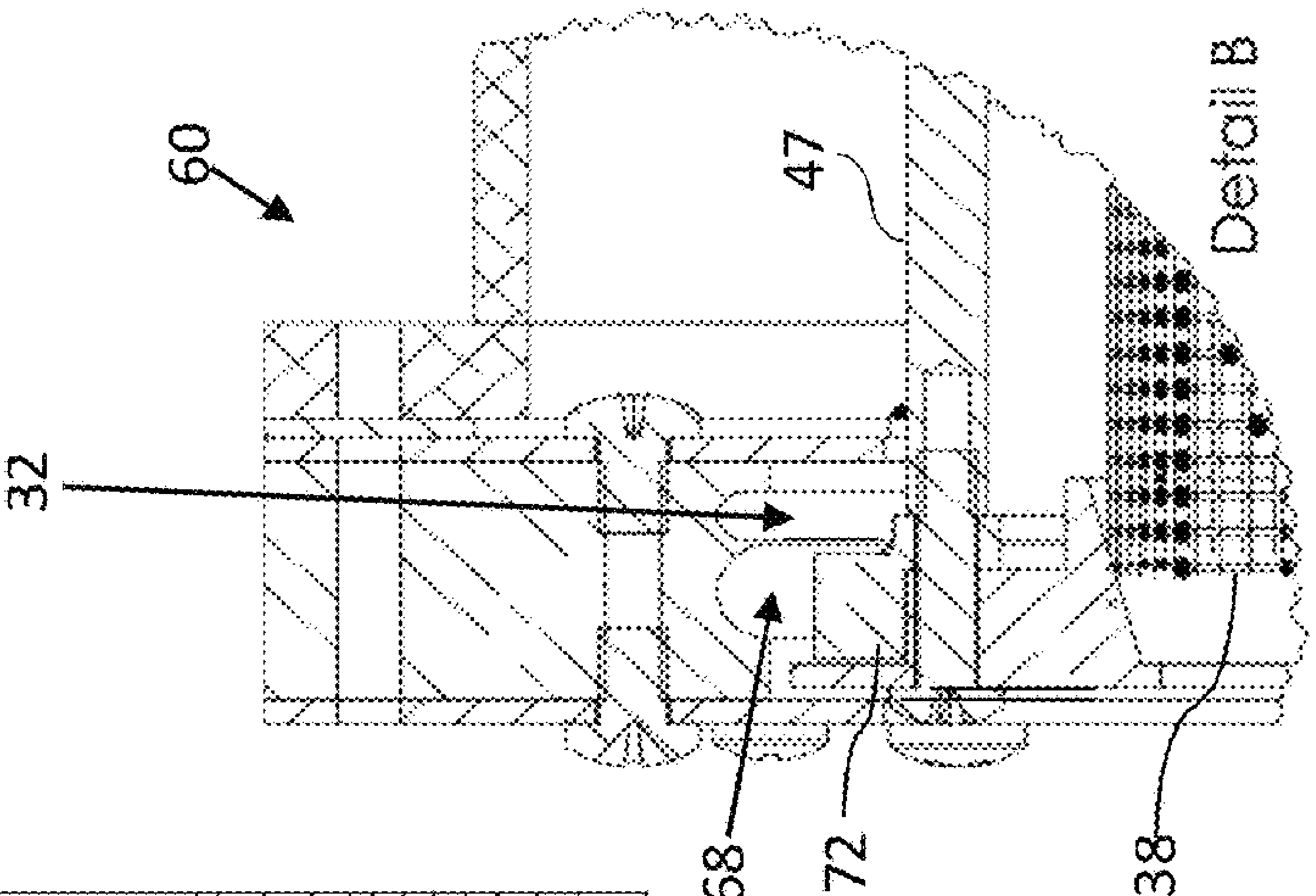

Figure 14C

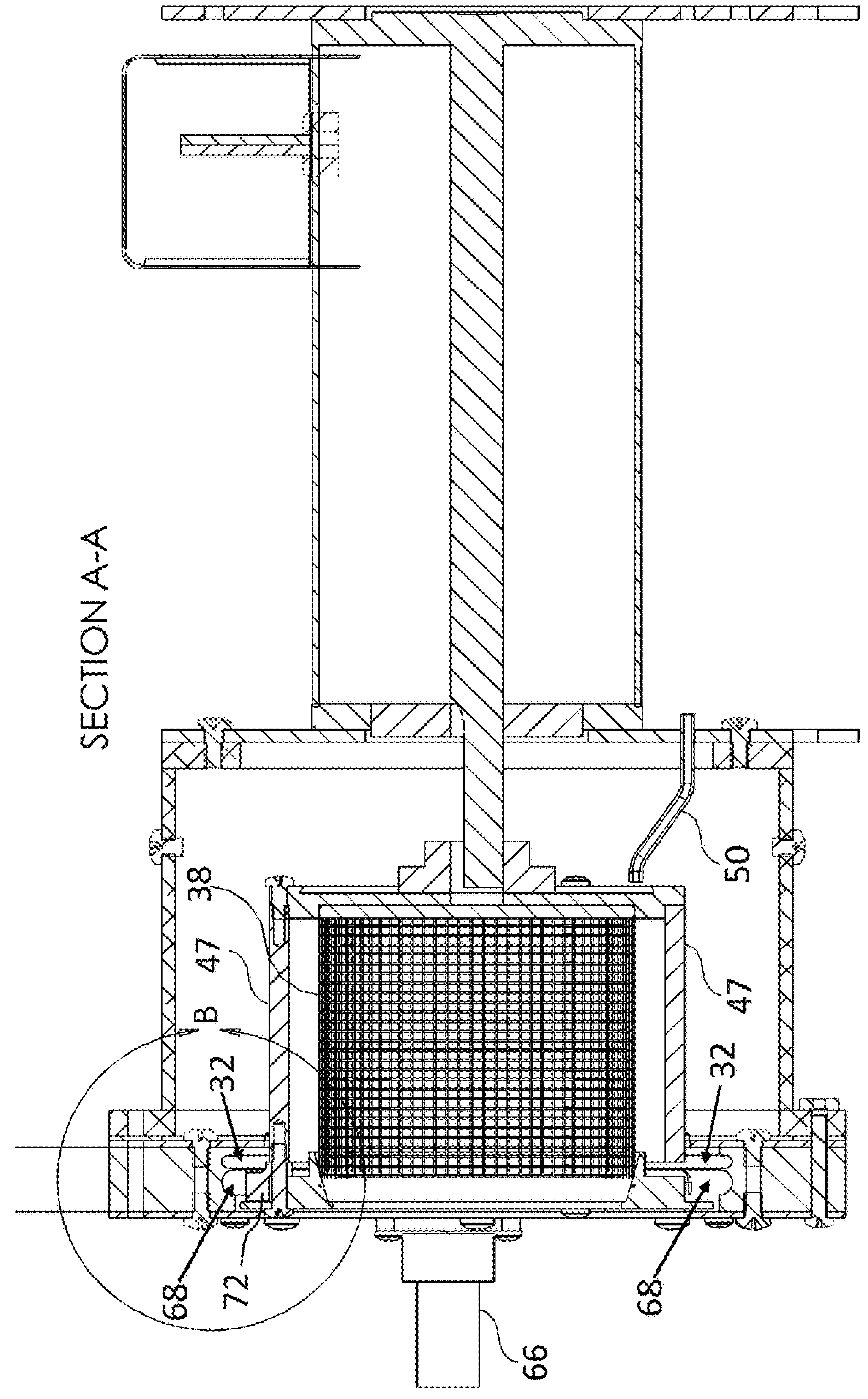

Figure 14B

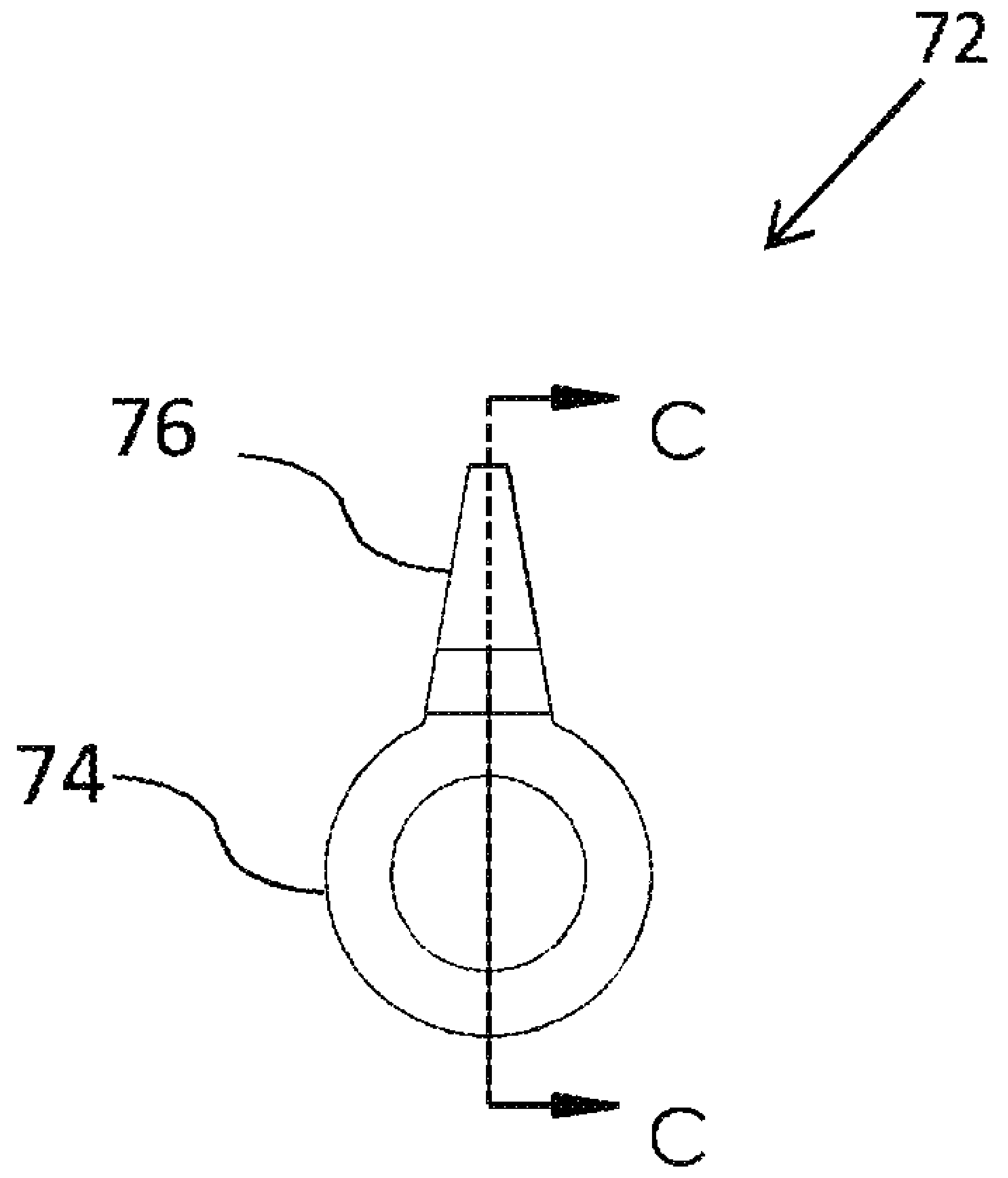

Figure 14D

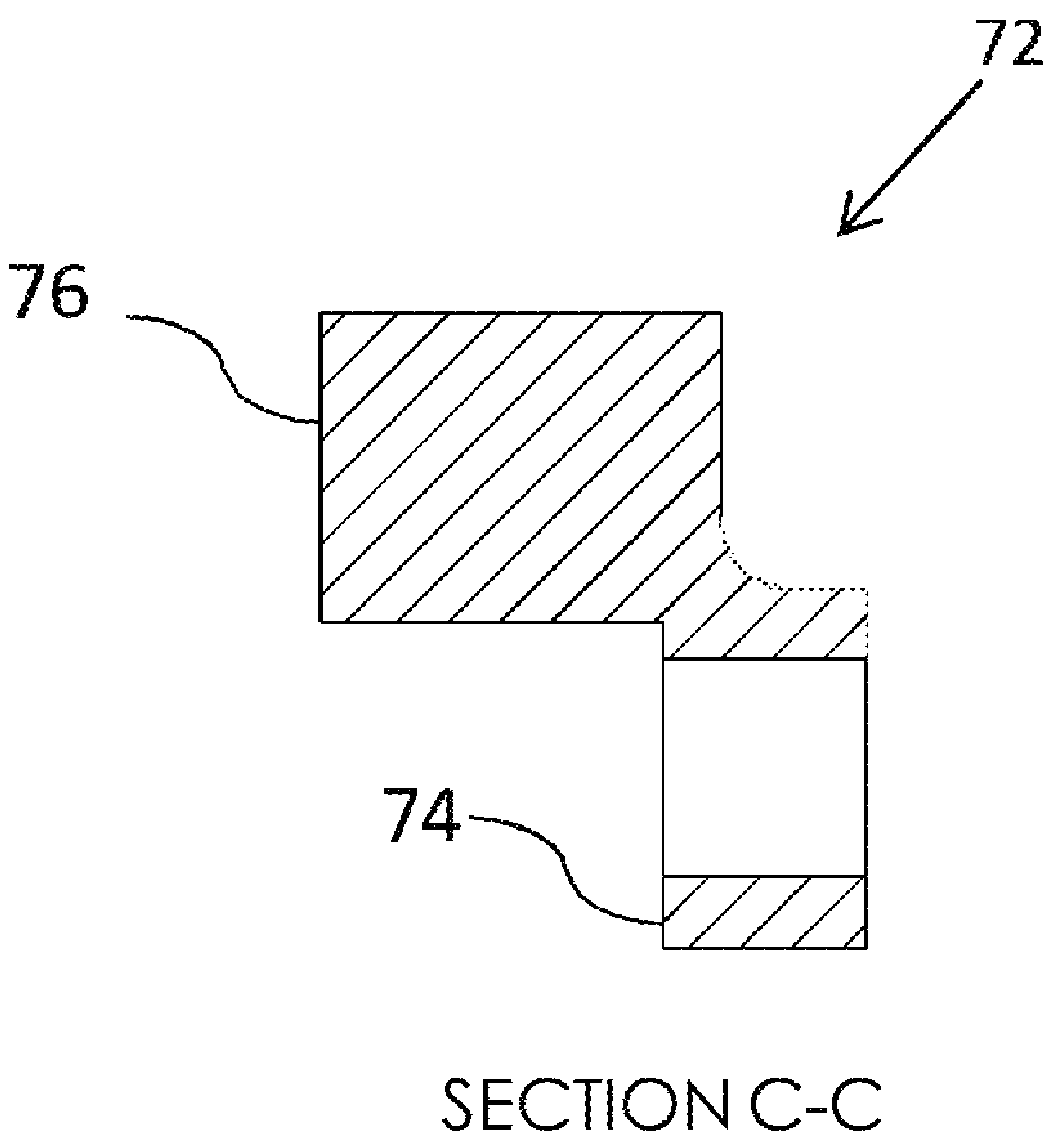

Figure 14E

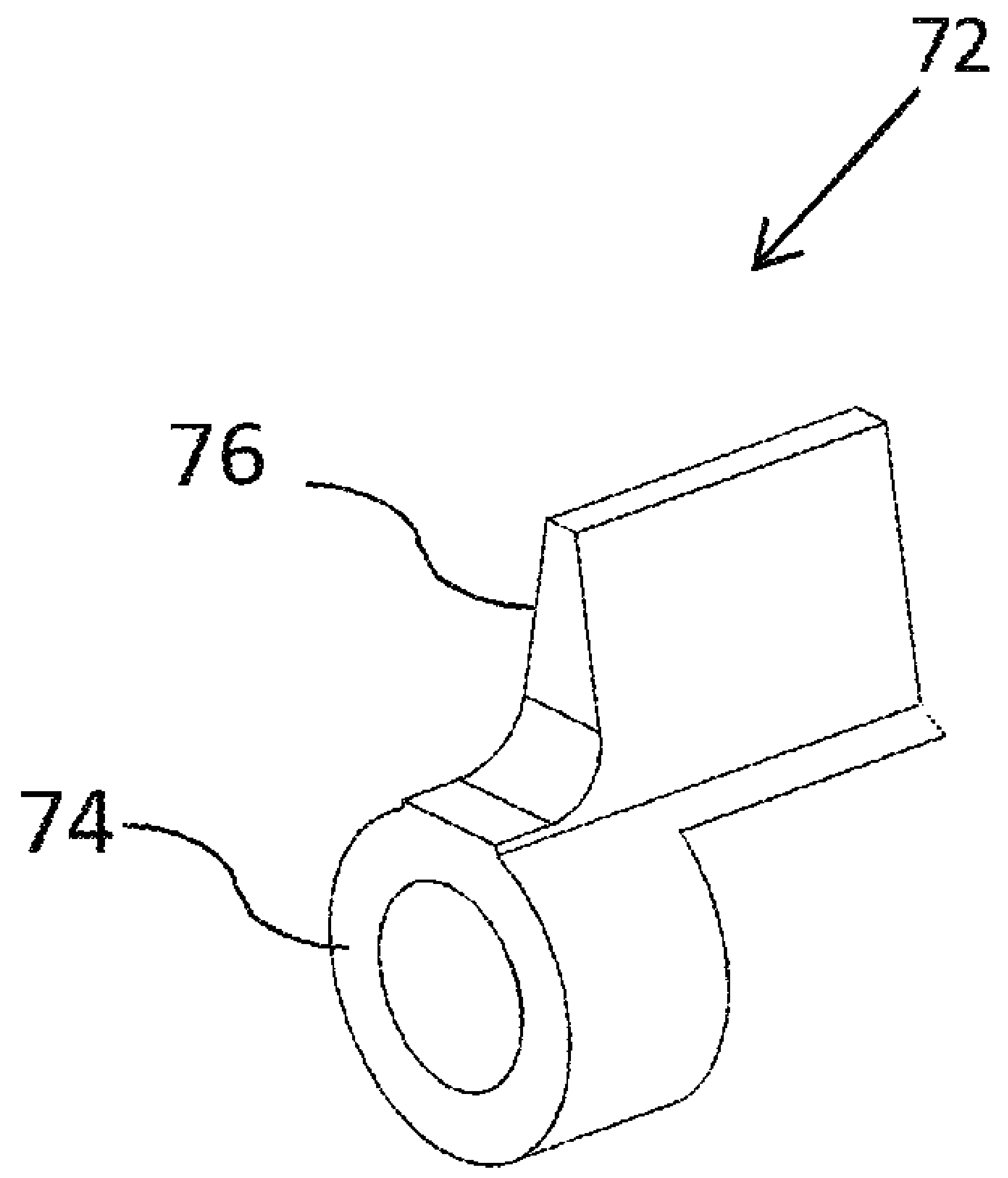

Figure 14F

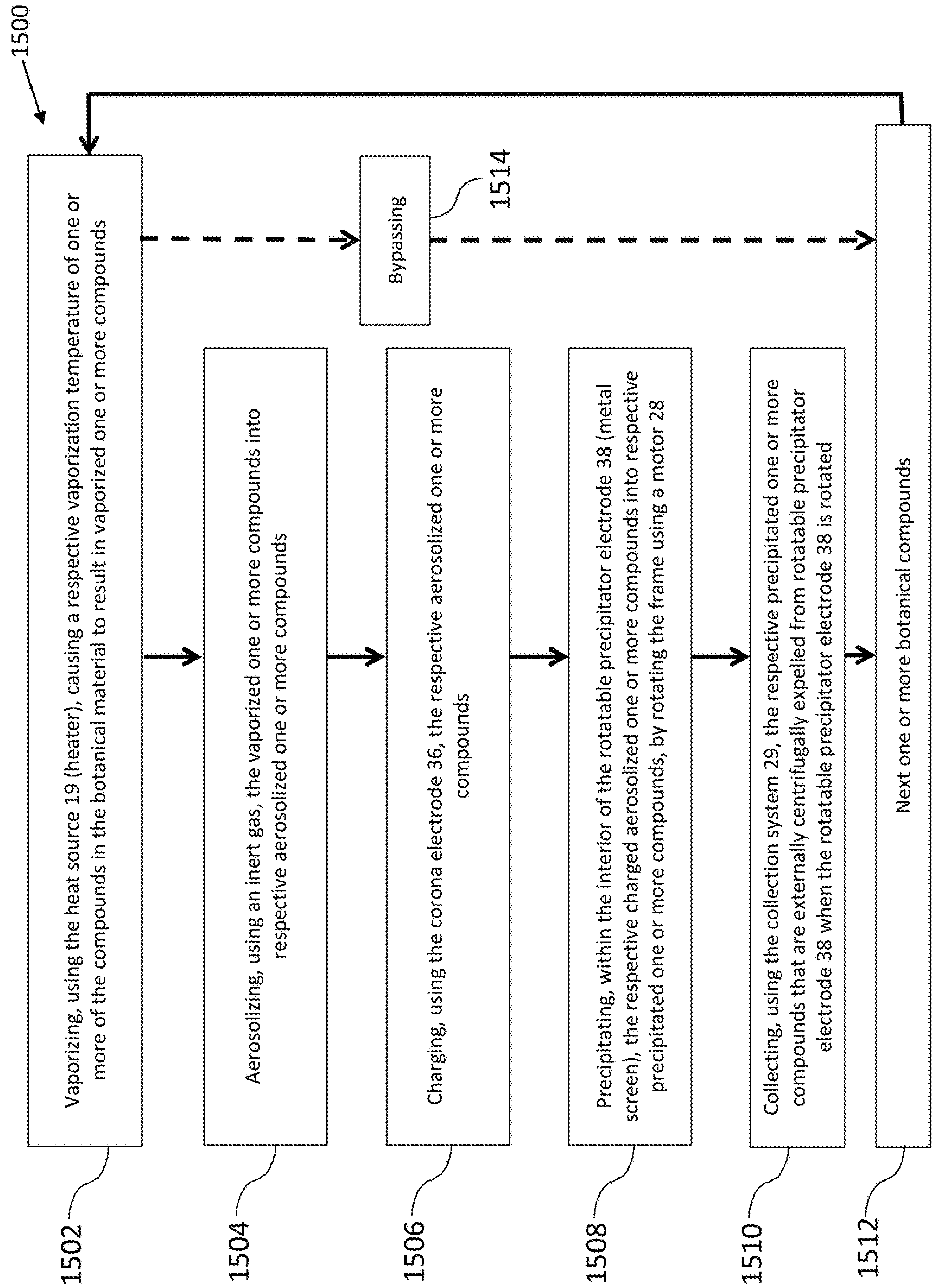
1500
1502
Vaporizing, using the heat source 19 (heater), causing a respective vaporization temperature of one or more of the compounds in the botanical material to result in vaporized one or more compounds
1504
Aerosolizing, using an inert gas, the vaporized one or more compounds into respective aerosolized one or more compounds
1506
Charging, using the corona electrode 36, the respective aerosolized one or more compounds
1508
Precipitating, within the interior of the rotatable precipitator electrode 38 (metal screen), the respective charged aerosolized one or more compounds into respective precipitated one or more compounds, by rotating the frame using a motor 28
1510
Collecting, using the collection system 29, the respective precipitated one or more compounds that are externally centrifugally expelled from rotatable precipitator electrode 38 when the rotatable precipitator electrode 38 is rotated
1512
Next one or more botanical compounds
1514
Bypassing

Figure 15

SYSTEM AND METHOD FOR EXTRACTING AND SEPARATING BOTANICAL OILS WITHOUT THE USE OF SOLVENTS

CROSS REFERENCE TO RELATED APPLICATION(S)

This application is a Continuation-In-Part of PCT Patent Application Serial No. PCT/CA2019/050231, filed Mar. 4, 2019 and entitled "SYSTEM AND METHOD FOR EXTRACTING AND SEPARATING BOTANICAL OILS WITHOUT THE USE OF SOLVENTS", which claims the benefit of priority to Canadian Patent Application Serial Number 3006692, filed May 30, 2018 and entitled "A SYSTEM AND METHOD FOR EXTRACTING AND SEPARATING BOTANICALS OILS WITHOUT THE USE OF SOLVENTS", the entire contents of these applications are herein incorporated by reference into the Detailed Description of Example Embodiments, herein below.

TECHNICAL FIELD

Example embodiments relate to extraction and separation of botanical oils and other compounds from plant material.

BACKGROUND

Botanical oils are presently extracted from plant materials (botanical materials); in general through the use of pressing or through some form of liquid solvent to dissolve and mobilize the oils to liberate them from the plant material. The solvents are later removed from the oils by evaporation or vacuum distillation techniques. Traces of some solvents may remain as a contaminant in the oil or compound, which may be detrimental or may restrict applications of the extracted oils or compounds, particularly if the oil or compound is intended for consumption such as for medicinal purposes, cosmetic purposes or recreational purposes.

In many of these solvent type processes, a broad spectrum mixture often results which may require further separation or fractionation processing to remove or segregate the various oils and compounds for different purposes applications or effects.

An example of such botanical extraction may be performed on *cannabis* botanical material. Solvent methods of liberating oils and other compounds from the *cannabis* botanical material tend to dissolve any and all oils and other compounds within the plant material, and the resulting broad spectrum product generally requires further fractional distillation processing to separate undesirable oils or compounds and solvent from the desired products before the extract can be used for its intended purpose. Different oils and compounds found in the same plant material may have widely differing and varying uses once separated. Some compounds may be considered toxic under certain conditions potentially limiting the applicability of certain extracts.

It may be advantageous to provide improved and efficient systems and methods for the harvesting of specific botanical oils and compounds from plant materials without the use of potentially contaminating solvents during vaporization or using conventional fractional distillation systems.

Additional difficulties with existing systems may be appreciated in view of the Detailed Description of Example Embodiments, herein below.

SUMMARY

Example embodiments relate to a system and method for the extraction and separation of botanical oils and other compounds from botanical material, for example for the purpose of extracting and separating multiple and various oils and other compounds from *cannabis* botanical material without the use of solvents or a conventional fractional distillation technique.

In an example embodiment, there is provided a system and a method for extracting and separating botanical oils and other compounds from botanical material comprising several oil or other compound types. The system and method can also be useful with other broad-spectrum compounds where practical, where it may be more convenient than conventional fractional distillation techniques.

According to an example embodiment, there is provided a system for extracting compounds from botanical material, comprising: a heater for sequentially vaporizing the botanical material at specified temperature values, each specified temperature value causing a respective vaporization temperature of one or more of the compounds in the botanical material to result in respective vaporized one or more compounds; a gas inlet for receiving an inert gas, the inert gas being for sequentially aerosolizing each of the respective vaporized one or more compounds into respective aerosolized one or more compounds; a corona electrode for sequentially charging each of the respective aerosolized one or more compounds; an electrostatic precipitator including a frame having a metal screen and the metal screen defines an interior for receiving and sequentially precipitating each of the respective charged aerosolized one or more compounds into respective precipitated one or more compounds, a motor for controlling rotation the frame having the metal screen around an axis of rotation to perform said precipitating; and a collection system at least part of which is positioned radially exterior from the frame having the metal screen with respect to the axis of rotation, the collection system for sequentially collecting each of the respective precipitated one or more compounds for each specified temperature value that are externally centrifugally expelled from the frame having the metal screen when the frame is rotated.

An example embodiment is method for extracting compounds from botanical material, comprising: sequentially vaporizing, using a heater, the botanical material at specified temperature values, each specified temperature value causing a respective vaporization temperature of one or more of the compounds in the botanical material to result in respective vaporized one or more compounds; for each of the vaporized one or more compounds from each specified temperature value: aerosolizing, using an inert gas, the respective vaporized one or more compounds into respective aerosolized one or more compounds, charging, using a corona electrode, the respective aerosolized one or more compounds, precipitating, within an interior of a metal screen of a frame, the respective charged aerosolized one or more compounds into respective precipitated one or more compounds, by rotating the frame using a motor, and collecting the respective precipitated one or more compounds that are externally centrifugally expelled from the frame having the metal screen when the frame is rotated.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference will now be made, by way of example, to the accompanying drawings which show example embodiments, and in which:

FIG. **1** is a schematic diagram of an example embodiment of a botanical extraction system.

FIG. **2** is a schematic diagram of a second example embodiment of a botanical extraction system.

FIG. **3** is a schematic diagram of a third example embodiment of a botanical extraction system including a fluid film product collection system.

FIG. **4** is a schematic diagram of a fourth example embodiment of a botanical extraction system including a vapor bypass system to reduce potential contamination of a centrifugal electrostatic precipitator of the botanical extraction system when deactivated.

FIG. **5** is a detailed diagram of a moveable belt collection system in accordance with an example embodiment.

FIG. **6** is a detailed diagram of a portion of a collection system including a centrifugally contained fluid film in accordance with an example embodiment.

FIG. **7** is a detailed diagram of a collection and segregation system in accordance with an example embodiment.

FIG. **8** is a process flow diagram for a method of extracting botanical oils from botanical materials without the use of a solvent, using the system of FIG. **1**.

FIG. **9** is a process flow diagram for a method of extracting botanical oils from botanical materials and segregating and distributing the oils into specific collection vessels based on vaporization temperature and exhausting selected vapors based on vapor temperature for separate processing or disposal, using the system of FIG. **3** or FIG. **6**.

FIG. **10** is a perspective view of an example embodiment of a physical version of the botanical extraction system.

FIG. **11** is a schematic diagram of a fifth example embodiment of a botanical extraction system including an Argon gas recirculating system.

FIG. **12** is a process flow diagram for a method of extracting botanical oils from botanical materials using the system of FIG. **11**.

FIG. **13** is a schematic diagram of a sixth example embodiment of a botanical extraction system including a pressure relief valve for controlling an operating pressure of the botanical extraction system.

FIG. **14**A is a side view of an example centrifugal electrostatic precipitator for the botanical extraction system, wherein the centrifugal electrostatic precipitator has paddle type vanes, in accordance with an example embodiment.

FIG. **14**B is a section view taken along A-A of FIG. **14**A.

FIG. **14**C is a detail view of circle B in FIG. **14**B.

FIG. **14**D is a side view of one paddle type vane for the centrifugal electrostatic precipitator shown in FIG. **14**A.

FIG. **14**E is a section view taken along C-C of FIG. **14**D.

FIG. **14**F is a perspective view of the paddle type vane shown in FIG. **14**D.

FIG. **15** is a flow diagram for a method of extracting botanical oils from botanical materials without the use of a solvent, in accordance with an example embodiment.

Similar reference numerals may have been used in different figures to denote similar components.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

Example embodiments include a system and method for extracting and separating botanical oils and compounds from botanical material comprising a vaporizing section which is further coupled to a centrifugal electrostatic precipitator for collection and segregation. The vaporizing section receives the botanical material through which a temperature-controlled inert gas is passed to evaporate specific vaporization temperature oils or compounds from the botanical material. The extracted vapor passes to the precipitator where the oil or compound is reduced back to the liquid state and is collected and segregated. The oils having the lowest vaporization temperature are collected first and the remaining oils are collected afterwards by specific and progressive vapor temperature control. Selected vaporized compounds are exhausted as vapor by bypassing the precipitator at specific known vaporization temperatures, thereby eliminating potentially toxic or undesirable oils or compounds from being collected.

According to an example embodiment, there is provided a system for extracting compounds from botanical material, comprising: a heater for sequentially vaporizing the botanical material at specified temperature values, each specified temperature value causing a respective vaporization temperature of one or more of the compounds in the botanical material to result in respective vaporized one or more compounds; a gas inlet for receiving an inert gas, the inert gas being for sequentially aerosolizing each of the respective vaporized one or more compounds into respective aerosolized one or more compounds; a corona electrode for sequentially charging each of the respective aerosolized one or more compounds; an electrostatic precipitator including a frame having a metal screen and the metal screen defines an interior for receiving and sequentially precipitating each of the respective charged aerosolized one or more compounds into respective precipitated one or more compounds, a motor for controlling rotation the frame having the metal screen around an axis of rotation to perform said precipitating; and a collection system at least part of which is positioned radially exterior from the frame having the metal screen with respect to the axis of rotation, the collection system for sequentially collecting each of the respective precipitated one or more compounds for each specified temperature value that are externally centrifugally expelled from the frame having the metal screen when the frame is rotated.

An example embodiment is method for extracting compounds from botanical material, comprising: sequentially vaporizing, using a heater, the botanical material at specified temperature values, each specified temperature value causing a respective vaporization temperature of one or more of the compounds in the botanical material to result in respective vaporized one or more compounds; for each of the vaporized one or more compounds from each specified temperature value: aerosolizing, using an inert gas, the respective vaporized one or more compounds into respective aerosolized one or more compounds, charging, using a corona electrode, the respective aerosolized one or more compounds, precipitating, within an interior of a metal screen of a frame, the respective charged aerosolized one or more compounds into respective precipitated one or more compounds, by rotating the frame using a motor, and collecting the respective precipitated one or more compounds that are externally centrifugally expelled from the frame having the metal screen when the frame is rotated.

According to an example embodiment, there is provided a system and method for extracting and separating various botanical oils and other compounds from botanical materials without the use of solvent chemicals, using a device having a first section configured to receive milled botanical material, and a second section in fluid communication with said first section. The method comprises of the steps of: heating the oil and other compound containing material in the first section by way of flowing heated inert gas over the oil containing botanical material in a similarly heated enclosure to a first temperature value sufficient to vaporize a specific botanical oil or compound characterized by a specific vaporization temperature, which flows into the second section and; converting in the second section the vaporized botanical oil or compound into an aerosol by mixing it with additional cooler inert gas to convert the vapor back into suspended liquid droplet aerosol, which is then precipitated in a centrifugal electrostatic precipitator and centrifugally expelled from the electrostatic precipitator onto a part of a collection system.

The method may further comprise using the measured first section vapor/gas exit temperature to identify specific vaporized oils or other compounds, and as a control parameter for the activation or deactivation of the aerosolization and centrifugal electrostatic precipitation process step, at specific measured first section exit temperatures or over a specific controlled first section exit temperature. Activation of the aerosolization and precipitation process step at specific measured exit temperatures or over specific controlled first section exit temperatures, allows for the subsequent collection of oils or compounds having specific vaporization temperatures.

Deactivation of the aerosolization and precipitation process step at specific first section measured exit temperatures, over specific controlled first section exit temperatures and/or bypassing the vapor around the second section allows for the subsequent exhausting of specific vapor temperature vapors from a vapor exhaust exit either directly or from the second section exhaust exit, thereby separating one or more specific unwanted vapor temperature oils or compounds from other desired specific vapor temperature oils or compounds and or preventing any contamination of the second section by undesired vapors.

According to an example embodiment, the liquid oils or other desired compounds may all be deposited onto a single removable collection surface by the centrifugal expulsion from the centrifugal electrostatic precipitator.

According to another example embodiment, the desired liquid oils may be deposited onto a single movable surface, which is in motion or is displaced periodically, such to cause the deposition of different vaporization temperature compounds onto different positions of the moveable surface, and as such result in categorization or fractionation of the oils or compounds as a function of position on the moveable surface. The moveable surface may be in the form a continuous belt of any suitable form, arranged to be surrounding the centrifugal electrostatic precipitator.

According to another example embodiment, there is provided the system including the first section vaporizer and the second section aerosolizer, centrifugal electrostatic precipitator and alternately comprising a centrifugally contained flowing film of distilled water or other suitable fluid, around the outside of the centrifugal electrostatic precipitator instead of the movable surface belt system, arranged to capture and transport the precipitated oil or other compound spun off from the centrifugal electrostatic precipitator and routed to a single fluid exit conduit for external collection in a single fluid vessel. The collected distilled water or other suitable fluid under the oil may subsequently be evaporated or drained from the collection vessel as required. Alternately the oil or other compound may be removed from the collection vessel to separate it from the distilled water or other suitable fluid.

According to another embodiment, the system including the centrifugally suspended flowing distilled water or other suitable fluid film around the outside of the centrifugal electrostatic precipitator, arranged to capture and transport the precipitated oil or other compounds spun off from the centrifugal electrostatic precipitator and routed to a single fluid exit conduit for external collection, also comprises a third collection section. The collection section is comprised of a series of removable liquid collection vessels which may be automatically positioned at a single common second section liquid output conduit, by use of a controlled carousel or other mechanical arrangement configured to position separate fluid collection vessels at specific first section exit vapor temperature values, such to collect specific vapor temperature compounds into specific collection vessels, thereby separating and distributing the various vapor temperature oils or other compounds into separate specific collection vessels. The remaining distilled water or other suitable fluid below the oil in the vessels may subsequently be evaporated or drained from the vessels to leave only the specific oil or other compound. Alternately, the oil or other compound may be removed from the vessels separating it from the distilled water or other suitable fluid.

Reference will be made below in detail to exemplary embodiments which are illustrated in the accompanying drawings. Wherever possible, the same reference numerals used throughout the drawings refer to the same or like parts.

FIGS. **1** to **4** and **11** illustrate example embodiments of a system **100** for extracting liquid oil droplets **12** from oil containing botanical material **1** without the use of liquid solvents or solvent chemicals. An example botanical material **1** is *cannabis* botanical material. The botanical material **1** can include a multiplicity of oils and other compounds. For example, a few of the many compounds *cannabis* botanical materials include at least some of the following which have different vaporization temperatures, at 0.05 mmHg (0.006666119 kPA): Cannabigerol (CBG, 52 Degrees C.), Toluene (110.6 Degrees C.), Beta-Caryophyllene (119 Degrees C.), Beta-Siteosterol (134 Degrees C.), Delta-9-Tetrahydrocannabinol (THC, 157 Degrees C.), Cannabidiol (CBD, 160-180 Degrees C.). There are many other known compounds some of which are desirable compounds and others, which are classified as toxins, have well defined vaporization temperatures greater than 180 Degrees C. and extending to above 230 Degrees C. In addition to compounds, in some examples, separation can be performed to extract specified compositions and specified elements, as applicable. Any of the described vaporizing temperatures presume 0.05 mmHg unless otherwise noted, and can be adjusted for changes in pressure, as applicable. For example, adjustment may be applied either by monitoring the pressure and compensating the temperatures or by controlling the operating pressure.

In some examples, pressure can be increased by introducing an inert gas such as Argon gas, thereby increasing the required respective vaporizing temperatures. In some examples, pressure can be reduced which reduces the vaporization temperature of the compounds in the botanical material **1**, for example using a vacuum, controllable valve, pressure relief valve, pressure chamber, or a combination thereof. In some examples, the environmental operating pressure may be adjusted by the process controller **18** when it is desired to alter the vaporization temperatures. For example, reducing the pressure lowers the required respective vaporization temperature, which is useful for compounds that may be damaged at higher temperatures, e.g. in some other pharmaceutical, chemical, cellular, or organic applications.

Referring to FIG. **1**, in general terms the system **100** is configured to receive botanical material **1** containing a number of compounds having different vaporization temperatures. The material is heated by flowing heated regulated Argon gas **3** from the gas inlet **2** over the botanical material in a similarly heated enclosure having an environment of inert heated regulated Argon gas **3** from the gas inlet **2** to specific temperature values for specific time durations, the process starting at the lowest vaporization temperatures such to vaporize the most volatile compounds first having lower vaporization temperatures (e.g. lower than 52 Degrees C.), followed by subsequently higher temperatures in order to vaporize the higher vaporization temperature compounds last in order to individually vaporize specific compounds. A centrifugal electrostatic precipitator **60** is used to individually precipitate each respective specific compound that are vaporized at each specific temperature value, for collection.

Due to the inert Argon gas **3** from the gas inlet **2**, the heating to specific temperature values for specific time durations is performed without oxidation, as no oxygen or gas contaminants are present in the environment of Argon gas **3**. As well, solvents (solvent chemicals, liquid solvents or otherwise) are not required for the heating during the vaporization and precipitation of any of the compounds of the botanical material **1**.

The system **100** can be controlled by one or more controllers, for example process controller **18** and controller **30** (see FIG. **8** and FIG. **9**). The process controller **18** is used to detect and control the overall components and functions of the system **100**. The process controller **18** can output a respective control signal **13** to control the various components. The process controller **18** can receive signals from various sensors and detectors of the system **100**. Another controller **30** (see FIG. **8** and FIG. **9**) can receive a control signal **15** from the process controller **17** and can output one or more control signals **13** to enable and disable electrostatic precipitation and aerosolization. In some examples, each of the controllers **18**, **30** can include a processor that executes instructions stored in a non-transitory computer readable medium. The controllers **18**, **30** can be combined in a single controller in some examples, or can each have their functions performed by a plurality of controllers in some examples. In some examples, the controllers can be hardware, software, or a combination of hardware and software.

An inert gas such as Argon gas is used in example embodiments. Argon gas is provided by Argon supply **20** as high pressure Argon gas **4** and then pressure regulated through Argon pressure regulator **21**, to output regulated Argon gas **3**.

The inert gas such as Argon gas is used to reduce the potential of oxidation processes during the vaporization stage and to prevent combustion of potentially combustible materials that may be a part of the botanical oil containing materials. The use of an inert gas in conjunction with an electrostatic precipitation stage also minimizes the potential of Ozone (O_3) production as well as Nitrous Oxide (N_2O) production eliminating other chemical reactions that may occur due to ionization effects that can happen with air in electrostatic precipitators.

The system **100** can include a housing that defines one or more sections, including a vaporization section **59** and a precipitator section **26**. The specified temperature values can be pre-programmed in a sequence into the process controller **18**, based on a time sequence in some examples, or based on sensor detection to proceed to the next compound in the sequence in some other examples. The vapor produced in the vaporization section **59** (having a semi-sealed oven enclosure **42**) is continuously passed on to the mixer section **24**, wherein at specific predefined temperature values, unheated Argon gas **5** is introduced using an associated gas inlet and mixed with the hotter vapor, in order to reduce its temperature to cause the vapor to revert to an aerosol state of suspended condensed droplets of the previously vaporized compound. The output from the mixer section **24** is aerosolized oil or other compound and Argon **7**.

A precipitator section **26** houses the centrifugal electrostatic precipitator **60**. At the same instant the unheated Argon gas **5** is activated using the solenoid valve **13** to flow throw the associated gas inlet, the centrifugal electrostatic precipitator **60** is also activated in order to start the precipitation process, which coalesces the aerosolized compound onto a rotatable precipitator electrode **38** that is rotating using a motor **28** having a rotor, and the rotatable precipitator electrode **38** includes a generally cylindrical frame made of a coarse metal screen. The coarse metal screen can be a stainless steel mesh, or other metal mesh. The coarse metal screen supports a very fine metal screen on its inside diameter, which forms the electrostatic precipitator ground electrode which facilitates the centrifugally generated flow of the electrostatically precipitated/coalesced liquid on the inner surface of the fine metal screen through both rotating metal screens. In an example, the size of apertures of the fine metal screen are of a size that permits passage of the oil droplet size of the coalesced liquid. In an example, the rotatable precipitator electrode **38** (e.g., the fine metal screen and the coarse metal screen) is grounded to ground or Earth ground, or controlled to be zero volts by an electrostatic power supply **11** or a suitable switch, for attracting of charged particles. In other examples, the rotatable precipitator electrode **38** is controlled by the electrostatic power supply **11** to be a controlled voltage that is different than the charge of the charged particles. The coalesced liquid is centrifugally ejected from the rotatable precipitator electrode **38** (when rotating) and collected by example collection systems **29** as further described herein. In an example, the used Argon gas **22** is exhausted out of the precipitator section **26** via a gas path exhaust conduit **8**, which also carries un-precipitated vapor present when the aerosolization-precipitation process is not activated, resulting in the exhausting and expelling of undesired vaporized compounds. The exhaust may be further processed in a separate system (not shown) as required. The rotatable precipitator electrode **38** is rotated at a fixed high speed by the motor **28**, such as 4000 revolutions per minute. In some examples, the rotatable precipitator electrode **38** is controlled to be rotated at variable speeds (e.g. partial speed, periodic modulating speed or sinsusoidal modulating speed) rather than a fixed maximal speed. In other examples, other actuators or drivers can be used instead of the motor **28**.

In one example embodiment, the vaporization section **59** is configured to receive botanical material **1** that is milled and contained in a drawer type cartridge **37**. The botanical material **1** includes a multiplicity of compounds having different vaporizing temperatures. The drawer type cartridge **37** containing the botanical material **1** is then inserted into the semi-sealed oven enclosure **42**, which is in the vaporization section **59** that is generally used to receive the botanical material **1** and for controlled vaporization of the botanical material **1**. In some examples, the drawer type cartridge **37** is removable, and after processing and extraction, the drawer type cartridge **37** is removed and the next drawer type cartridge **37** containing the next botanical material **1** is inserted into the semi-sealed oven enclosure **42**. See, for example, FIG. **10** which illustrates the next drawer type cartridge **37** that can be processed and collected.

At the beginning of the process following the installation of the botanical loaded drawer type cartridge **37**, the semi-sealed oven enclosure **42** is initially flooded with a pre-set flow of ambient temperature Argon gas **3** from the gas inlet **2** to substantially remove any oxygen from the enclosure environment of the vaporization section **59** and the precipitator section **26**, and also to some degree from the enclosure of the loaded drawer type cartridge **37** and the botanical material **1** contained within. In some examples, at the same time as the initial flooding with the Argon gas **3** from the gas inlet **2**, a vacuum suction is used to partially or fully evacuate the semi-sealed oven enclosure **42**, the mixer section **24**, and the precipitator section **26**, to initially remove oxygen and other ambient gases via the gas path exhaust conduit **8**.

The drawer type cartridge **37** and the semi-sealed oven enclosure **42** are arranged such that Argon gas **3** from the gas inlet **2** is forced to flow through the containment screen **39** on the upper surface (top sidewall) of the drawer type cartridge **37** through the milled botanical material **1** and out through the containment screen **41** on the lower side (bottom sidewall) of the drawer type cartridge **37**. Some examples include recirculated Argon gas **22** from the gas path exhaust conduit **8** in addition to or in place of Argon gas **3** from the Argon gas supply **20**. In some examples, an initial injection of Argon gas **3** is provided by the Argon gas supply **20**, followed by recirculation of any of the used Argon gas **3** to the extent possible.

The flowing Argon gas **3** and the semi-sealed oven enclosure **42** are gradually heated at a controlled rate by a heat source **19** (heater) to a first specified vapor temperature value that corresponds to a desirable compound vaporizing temperature of one or more of the compounds within the milled botanical material **1**. In an example, the heat source **19** can generally surround the semi-sealed oven enclosure **42** and the gas inlet **2**. The temperature **14** of the oven exit vapor **6** of the semi-sealed oven enclosure **42** is detected by one or more respective temperature sensors **64**, and the temperature **14** is received, monitored and controlled by the process controller **18**, by using the heat source **19** to controllably heat both the Argon gas inlet **2** and a wall temperature of the semi-sealed oven enclosure **42**, simultaneously. In some examples, the heat source **19** can have the desired specified temperature regulated using feedback from the temperature **14** of the exit vapor **6** (by one or more temperature sensors **64**). In some other examples, the heat source **19** is self-regulated and/or calibrated to provide the desired temperature **14** of the exit vapor **6**.

In some examples, the temperature that the Argon gas **3** is heated through the gas inlet **2** into the semi-sealed oven enclosure **42** before it encounters the milled botanical material **1** is higher than (greater than) the specific vapor temperature being targeted. The higher temperature by the heat source **19** is used prior to entry to the semi-sealed oven enclosure **42** because, in an example, the measured temperature of the exit vapor **6** from the semi-sealed oven enclosure **42** is used for the control feedback for the controlling of the heat by the heat source **19** being input to the semi-sealed oven enclosure **42**. The actual temperature of the Argon gas **3** will cool by some amount as the particular compounds of the milled botanical material **1** are absorbing energy when being vaporized (heat of vaporization is supplied by the energy in the Argon gas to the milled botanical material **1**). In some examples, one or more temperature sensors **64** detects the temperature of the exit vapor **6** immediately as the vapor is formed, and the temperature is used as a control or process value that is measured and fed back to the heater power control input though the process controller **18**. The power to the heat source **19** is controlled by the process controller **18** to maintain the vapor on vaporization to a specific temperature, not to control the temperature of the gas being supplied to the vaporizer (this is how the energy reaches the material), which is used to vaporize the compound. The vapor temperature upon evaporation of the exit vapor **6** will be at the vaporization temperature of the compound (this is measured right at the exit of the drawer type cartridge **37** since it could become heated or cooled further downstream of this location). If the gas flow rate varies, the input gas temperature will vary by control from the process controller **18** to compensate and hold the vapor temperature fixed at the controlled value by the feedback loop controlling the power to the heat source **19**.

Since the compound vapor temperatures are defined by the chemistry of the compound (at any given pressure), the vaporization temperature identifies the specific compound. By controlling the vapor temperature at vaporization by adjusting the power (heat input) supplied by the heat source **19** to the (un-defined) gas flow, the process controller **18** automatically controls the actual heat of vaporization, input to the (un-defined amount of) compound from the milled botanical material **1** for any specific compound having a given vaporization temperature.

In some examples, the process controller **18** detects the completion of vaporization at any given control temperature (compound or group of compounds) by the impedance characteristic (e.g., using an electrical energy sensor **62** such as a voltage sensor and/or current sensor) within the centrifugal electrostatic precipitator **60**, thus determining when a specific vapor is partially or completely evaporated and collected (or removed). The particular variable impedance characteristic can be detected by one or more sensors, or calculated from sensor information from those one or more sensors. The detection of a breakdown voltage of a spark gap can be used in some examples in place of the impendence sensor to determine that a specific vapor is completely evaporated and collected (or removed), or is below a threshold. The sensor information to determine the impedance characteristic can be used by the process controller **18** for vaporizing of the next one or more compounds from the milled botanical material **1** having the next higher respective vaporizing temperature.

After flowing the Argon gas **3** via gas inlet **2** through the botanical material **1**, the vaporized compounds mixed with Argon as exit vapor **6** flows into a mixer section **24**, wherein at the first specified temperature value the vapor is mixed with a separate controlled flow of unheated Argon gas **5** as the process controller **18** activates flow of the unheated Argon gas **5** via a solenoid valve **23** at said first specified temperature value.

FIG. **4** is a schematic diagram of a fourth example embodiment of a botanical extraction system including a vapor bypass system to reduce potential contamination of the centrifugal electrostatic precipitator **60** when deactivated. Until the first specified temperature value is reached, any vapors that may be exiting from the vaporizer section is not mixed with cooler Argon gas **5** and flows through the precipitator section **26** and out of the gas path exhaust conduit **8** and or flows directly out of the bypass annulus **55** (or other exhaust outlet or exhaust cavity) and out of the gas path exhaust conduit **8**. In addition to no flow of unheated Argon gas **5** prior to the first specified temperature value, the electrostatic power supply **11** to one or more corona electrodes **36** is held at zero voltage by power supply **25**, to prevent charging of the vapors and any corona action from the corona electrodes **36**, and thereby disabling electrostatic precipitation from occurring in the rotatable precipitator electrode **38**.

Referring still to FIG. **4**, the motor **28** used to drive the rotatable precipitator electrode **38** is also controlled to operate at zero or a low speed prior to the any specified temperature value being attained to prevent potential impact related coalescence of the undesired vapors, as they pass through the inoperative centrifugal electrostatic precipitator **60** and out of the gas path exhaust conduit **8**, and/or the vapors are bypassed around the precipitator section **26** via the annular bypass duct **53** thus exhausting unselected compounds from the system **100** prior to the specified temperature value being attained by the temperature **14** of the exit vapor **6**. Further treatment or processing may be applied to the exhaust vapors from the gas path exhaust conduit **8** in a separate system (not shown) as required. In some examples, the Argon gas **22** exhausted from the activated centrifugal electrostatic precipitator **60** is recirculated (having been electrostatically cleaned by the centrifugal electrostatic precipitator **60**) through one circuit to the heater and drawer type cartridge **37** and also via a cooling heat sink (e.g., heat sink tube **80** FIG. **13**) to the mixer section **24** for re-injection into the precipitator **60**. In such examples the un-heated Argon supply **20** from the Argon pressure regulator **21** may be reduced or stopped to conserve Argon gas consumption. In such an arrangement, the Argon gas supply **20** may only be used when un-precipitated vapors are exhausted from the system **100** to replace any Argon gas lost in the exhaust, or when additional Argon gas is required (e.g. to increase the present pressure).

Once the first specified temperature value has been attained, compounds of that specific vaporization temperature will begin to vaporize rapidly from the botanical material **1** and will be transported as hot exit vapor **6** from the semi-sealed oven enclosure **42** into the mixer section **24** where the bypass to bypass duct **53** has been deactivated and the unheated regulated Argon gas **5** is activated as the first specified temperature value is reached, and the charge of the centrifugal electrostatic precipitator **60** is activated and rotation action using the motor **28** is activated to rotate the centrifugal electrostatic precipitator **60** around an axis of rotation. The vaporization temperature of each respective compound is at least the boiling point of that compound, taking into account the present pressure (the present pressure can be controlled in some examples).

The hot exit vapor **6** can be mixed with unheated Argon gas **5** and as a result will suddenly cool to a temperature below the vaporization temperature, causing the vaporized compound to begin to condense into an aerosol of suspended microscopic droplets, which becomes exposed to the now activated generated ions from the corona electrodes **36**, resulting in electrostatic charging of the suspended droplets, and the subsequent electrostatic attraction to the (now rotating) rotatable precipitator electrode **38**. The rotatable precipitator electrode **38** is conductive due to the fine stainless steel screen. In some examples, the precipitator electrode **38** is grounded, forming a grounded plate electrode of the centrifugal electrostatic precipitator **60**.

The electrostatic action results in the microscopic droplets and possibly remaining vapors to coalesce as a liquid into the rotating rotatable precipitator electrode **38**. As the droplets collect on the fine stainless steel screen and coalesce into larger liquid droplets, the centrifugal forces that build up as the droplet mass increases with size, causes the larger droplets to be ejected free from the rotating rotatable precipitator electrode **38** outside surface in a tangential direction, to be captured by one of several different possible collecting systems to be described in more detail below. The remaining Argon gas and any potentially un-precipitated vapor pass out of the precipitator section **26** via the gas path exhaust conduit **8** or in some examples are re-circulated for re-use (the recirculation is explained in greater detail herein).

After a predetermined period of time or specified precipitator impedance characteristic or discharge detected signal **54** at the specific temperature value, the process controller **18** disables the aerosolization and electrostatic precipitation action by deactivating flow of the unheated Argon gas **5** and the corona electrodes **36**, reactivating the bypass flow, deactivating the electrostatic power supply **11** (when used) and slowing or stopping the motor **28**.

The process controller **18** then begins to increase the temperature of the semi-sealed oven enclosure **42** and Argon gas **3** through gas inlet **2** flow to achieve the next specified vaporization temperature, in a controlled ramping upwards of the temperature **14** of the exit vapor **6** of the semi-sealed oven enclosure **42** in precisely the same way as was done for the first specified temperature, whereby this identical process is repeated for any number of respective predetermined specific temperature values where the vapor temperature of desired compounds are known.

In some cases there are compounds which are not desired to be collected and have known vapor temperatures, for example at 0.05 mmHg: Toluene at 110.6 Degrees C., or Benzene at 200 Degrees C. or Naphthalene at 218 Degrees C., which are all listed as toxic compounds. Some of these particular compounds can have vapor temperatures below some desirable compounds (e.g. lower than 52 Degrees C.) and above others (e.g. greater than 180 Degrees C.), and can be evaporated and disposed of from the milled botanical material **1** by attaining the specific vaporization temperature values for a specific period of time but without activating the precipitator section **26**, and/or selectively bypassing the vapors around the precipitator section **26** such to exhaust these undesirable compounds as un-precipitated vapor, preventing any specifically selected compounds of specific vaporization temperatures from being collected and potentially mixed with other more desirable compounds. The exhausted vapors may undergo further treatment or processing in a separate system in some examples (not shown).

The liquid oil droplets **12** are precipitated compounds by the centrifugal electrostatic precipitator **60** and are ejected from the centrifugal electrostatic precipitator **60**, which are then collected in one of several possible different collection systems **29** which range from very basic arrangements of lower cost to more sophisticated arrangements which allow for the separate collection of each compound of a specific vapor temperature.

In an example embodiment as depicted by FIG. **1** and FIG. **8**, the collection system **29** includes a removable sleeve **44**, which is held in a position around the rotatable precipitator electrode **38**, by a support system **40** such that the precipitated compounds (typically an oil) ejected from the rotating rotatable precipitator electrode **38** impact and attach to the removable sleeve **44** by adsorption. The removable sleeve **44** may be removed to gain access to the deposited compound and replaced with a clean removable sleeve **44** for the capture of a different vapor temperature compound, or may be left in place to collect several different compounds. The support system **40** may be cooled by some known method during operation, to allow the removable sleeve **44** and deposited compounds to be cooled as required.

In another example embodiment of the system **100** as depicted by FIG. **2**, FIG. **5** and FIG. **8**, in this collection system **29** the removable sleeve **44** and support system **40** is replaced with a belt support sleeve **45** arranged to allow the threading of a moveable belt **46** of material, suitable for the deposition of compounds from the centrifugal electrostatic precipitator **60** (parchment paper belt or a suitable silicon compound belt of some form), such that it circumferentially surrounds the rotatable precipitator electrode **38** and provides 360 degrees of collection surface, that can be withdrawn tangentially guided by the belt support sleeve **45** so as to change the exposed 360 degree surface to a clean surface for collecting the next temperature precipitated compound, while the surface having the deposited specific compound is now exposed on the outside of the system providing access to the deposited compound. This arrangement provides a simple method to collect the compounds having different vapor temperatures while separating them from each other. The belt support sleeve **45** may be cooled by known methods to maintain the temperature of the movable belt **46** of material and deposited compound to a relatively lower temperature as required.

In another example embodiment of the system **100** as depicted by FIG. **3**, FIG. **6** and FIG. **9**, in this collection system **29** the belt support sleeve **45** and movable belt **46** has been replaced by a rotatable sleeve **47**, which is attached to, and rotating with the rotor of the motor **28** that controls the rotatable precipitator electrode **38**, and is further provided with a small flow of distilled water or other fluid from a controlled source of fluid supply **31** (e.g. reservoir or tank) into the motor end of the rotatable sleeve **47**. The distilled water or other fluid is only fed to the rotatable sleeve **47** while the centrifugal electrostatic precipitator **60** is active, by utilizing the solenoid controlled pressure of the Argon gas **5** to pressurize the fluid supply **31**, to cause distilled water or other fluid to flow through the conduit **50**, when pressurized. The distilled water or other fluid introduced to the rotatable sleeve **47** is constrained by centrifugal force to form an axially flowing distilled water or other fluid film **48** along the inside surface of the rotatable sleeve **47** and flows in an axial direction towards the open end of the rotatable sleeve **47**, collecting compound ejected from the rotating rotatable precipitator electrode **38**, where the water or other fluid plus compound is ejected in a tangential direction from the open end of the rotatable sleeve **47** either from the edge of the rotatable sleeve **47**, or from a series of radial holes (not shown) in the rotatable sleeve **47**. In examples, the distilled water or other fluid is not considered a solvent here because it does not dissolve the collected compound, but rather supports motility of the collected compound. The distilled water or other fluid compound **49** is ejected from the rotatable sleeve and is captured in an annular fluid conduit **32**, which is further connected to a tangentially directed drain conduit **51** (see FIG. **7**).

Referring to FIGS. **11** and **14**A, **14**B, and **14**C, in an example system **100** that includes recirculation of the Argon gas, a tangential gas duct **68** and recirculation conduit **66** located next to the annular fluid conduit **32** is arranged to carry the expelled Argon gas **22** which is being expelled from the rotatable precipitator electrode **38** from which the vapors have been precipitated from the Argon gas **22** (e.g. electrostatically cleaned) for recirculation of the Argon gas **22**. FIG. **12** is a process flow diagram for extracting botanical oils from botanical materials using the system **100** of FIG. **11** and FIGS. **14**A, **14**B and **14**C. Therefore, the system **100** can have a dual tangential duct arrangement to collect the liquid ejection separate from the Argon gas that will be ejected from the rotatable precipitator electrode **38**.

In some examples, the cool Argon feed at the mixer section **24** is the only feed input for the Argon gas to the semi-sealed oven enclosure **42**. In some examples, there is only recirculated Argon gas to the gas inlet **2**, and no direct feed of fresh Argon gas from the Argon supply **20** to the semi-sealed oven enclosure **42** to the gas inlet **2**.

The Argon gas now collected from the tangential gas duct **68** and through the recirculation conduit **66** is fed to the heat source **19**, wherein the Argon gas **22** has been electrostatically cleaned in the rotatable precipitator electrode **38** and partially pressurized by the tangential ejection from the rotatable precipitator electrode **38**, and the Argon gas **22** is re-circulated back to the semi-sealed oven enclosure **42** for re-use. This reduces the power requirement for raising the temperature of the Argon gas **22** and significantly reduces the potential waste of Argon gas that would otherwise be wasted in the process when the Argon gas is removed as exit exhaust only. A portion of the recirculated Argon gas flow can be cooled and used as the cool Argon gas added to the vapor flow entering the precipitator section **26** (in the mixer section **24**), as an alternative to the un-heated Argon gas from the external Argon supply **20** of regulated Argon gas **3**.

There are some example practical reasons for the recirculation of Argon gas **22**: first, significant reduction in the consumption of Argon gas while increasing the net Argon gas flow around the circuit; second, reduced power consumption in heating the Argon gas; third, reduced temperature differential between the Argon gas (semi-sealed oven enclosure **42**) and the desired vapour temperature (due to higher Argon gas through flow).

In some examples, as shown in FIGS. **14**B and **14**C, there are a plurality of paddle type vanes **72** attached at the exit slot on the rotatable sleeve **47**. Also, there is the tangential gas duct **68** around the rotatable sleeve **47** which exits to the recirculation conduit **66**, therefore the system **100** now has two separate ducts, one for the fluid (water and oil) and one for the Argon collection for recirculation which now feeds the semi-sealed oven enclosure **42** with recirculated Argon gas instead of the fresh regulated Argon gas **3** from the Argon supply **20**. The fresh cool Argon gas is now supplied directly to the mixer section **24**. The Argon gas **22** can also be recirculated from the rotatable precipitator electrode **38** to the recirculation conduit **66**, which is pumped by the rotor tangential ejection action of the rotatable precipitator electrode **38**, plus the paddle type vanes **72** in this example.

FIGS. **14**D, **14**E and **14**F illustrate one of the paddle type vanes **72** in greater detail. As shown, the paddle type vane **72** includes a mount **74** which can define an annulus. The mount **74** is fixedly mounted to the rotatable sleeve **47**, and rotates along with the rotatable sleeve **47**. The paddle type vane **72** includes a vane **76**, wherein the vane **76** has an aerodynamic shape that rotates with the rotatable sleeve **47**, to assist in flow of the recirculated Argon gas **22** to the tangential gas duct **68**.

During operation of the system **100** where specific compounds are being precipitated and ejected from the rotating rotatable precipitator electrode **38**, the rotatable sleeve **47** supporting the distilled water or other fluid film **48** captures the compound, which is then transported by the fluid flow **49** via the annular fluid conduit **32** and out through the drain conduit **51** (FIG. **7**) where it may be collected in a collection vessel **52** of a plurality of collection vessels **52**. Each collection vessel **52** can be manually or automatically changed for each specific vapor temperature compound. Since the vaporized botanical compounds are in general oils of lower density than water, the compounds will generally remain on the surface of the distilled water or other fluid and are easily separated either mechanically (not shown) or by evaporation of the distilled water or other fluid by a further system or method (not shown). FIG. **7** also illustrates the axis of rotation of the rotatable precipitator electrode **38**.

In some examples (not shown), the fine stainless steel screen, the coarse metal screen, and the rotatable precipitator electrode **38** are partially conical rather than cylindrical, with the smaller radius at the end facing the distilled water or other fluid supply conduit **50** and the larger radius facing the annular fluid conduit **32**. This generally conical shape facilitates flow of the water or other fluid plus compound towards the annular fluid conduit **32**. The generally conical rotatable precipitator electrode **38** can be rotated along its central longitudinal axis, and generally operate in a similar manner as the cylindrical case described herein.

In example embodiments, it can be appreciated that two or more types of compounds from the botanical material **1** can be processed and collected at one time, within one iteration of the process performed by the system **100**. For example, in some applications it may be desired to collectively collect both THC and CBD at one time, for example into one collection vessel **52**. In such examples, the specified vaporizing temperature can be controlled via the heat source **19** to be in a range of temperatures between the vaporization temperatures of the two or more types of compounds from the botanical material **1** (THC and CBD in this example), or alternatively can be increased to and maintained at the higher vaporization temperature of the desired two or more compounds (CBD requires the higher vaporization temperature in this example).

The controller **30** is used to sense and control the various components of the system **100**, including the various sensors, solenoid valve **23**, the electrostatic power supply **11**, the power supply **25** and the motor drive control **27**, in order to enable or disable various aspects of the vaporization, electrostatic precipitation and aerosolization.

In an example embodiment of the system **100** depicted in FIG. **7** and FIG. **9**, the drain conduit **51** is arranged to output the distilled water, or other fluid plus compound **49** to a collection vessel indexing system **33** for automated positioning of each collection vessel **52** of the plurality of collection vessels **52**. Each collection vessel **52** is used to collect specific distilled water, or other fluid plus compound **49** (e.g. compound is suspended botanical oil), where the collection vessels **52** are each incrementally replaced for collecting at each specific vaporization temperature value. The collection vessel indexing system **33** provides for automated separation of specific botanical compounds based on each respective vaporization temperature. At least one collection vessel **52** is used to collect product **34** from the drain conduit **51**. FIG. **7** and FIG. **9** illustrate multiple separated products **35**, one different separated product **35** for each collection vessel **52**. In other examples, more than one product **35** (but not all) is collected in at least one of the collection vessels **52**. The collection vessel indexing system **33** can include a conveyor **58** such as a rotary turnstile for supporting each collection vessel **52** (see e.g. FIG. **10**). The conveyor **58** can also comprise a linear conveyer belt (not shown) in other examples.

FIG. **13** is a schematic diagram of another example embodiment of a botanical extraction system **100** that includes a pressure relief valve **70** for controlling an operating pressure of the system **100**. The features of the system **100** of FIG. **13** can be used in the other described examples of the system **100**, e.g. as in FIGS. **1**, **2**, **3**, **4**, **11**. The system **100** of FIG. **13** controls the operating pressure and also facilitates recirculation of the Argon gas flow. In some examples, the pressure relief valve **70** has a very low pressure relief valve setting, such that introducing fresh Argon gas into the bypass annulus **55** results in flow out of the pressure relief valve **70** as waste exhaust through bypass duct **53** and gas path exhaust conduit **8** (not shown here). This allows control of the maximum pressure within the complete system **100**. Examples of the pressure relief valve **70** include those similar to a pressure cooker, wherein a weight on a pin arrangement or a floating metal ball is lifted by the pressure, allowing venting. The pressure relief valve **70** also helps to better define the vaporization temperatures at different location altitudes or atmospheric conditions, because the pressure relief valve **70** assists in generally maintaining the desired pressure so that the characteristic boiling points of the one or more compounds are not varying while in operation due to their dependency on pressure.

In some examples, the pressure relief valve **70** is controllably activated by the process controller **18** using a suitable control signal. A solenoid valve (not shown) can be used for the activation.

In some examples, the pressure relief valve **70** is activated by the process controller **18** by initializing input Argon flow to the bypass annulus **55**, to increase pressure such to cause the pressure relief valve **70** to inherently open and as such venting from the pressure relief valve **70** the bypass circuit. The cool or un-heated Argon gas for aerosolization in the mixer section **24** will now be part of the re-circulated Argon gas after passing through a heat sink tube **80** or other cooling tube, which can be branched off, re-circulated flow, and fed back into the mixer section **24** after the cooling through the heat sink tube **80**, as shown. The Argon gas input to the mixer section **24** can be used to initially charge the vaporization section **59** and the precipitator section **26** before the heating and vaporizing, allowing any air in the system to vent out via the pressure relief valve **70** while the rotatable precipitator electrode **38** is rotating. The rotating rotatable precipitator electrode **38** pumps the recirculated Argon gas flow around the system **100** so that the air in the system **100** exits via the pressure relief valve **70**, and stops flowing once the process controller **18** shut off the Argon gas **5** inlet flow. To bypass un-wanted vapors, the rotatable precipitator electrode **38** is de-activated and the rotor of the motor **28** may be slowed or stopped, and the fresh Argon gas supply is turned on resulting in flow both through the precipitator section **26** and out to the vaporization section **59**, and also backwards into the bypass annulus **55** and the associated exhaust cavity and out through the pressure relief valve **70** to the gas path exhaust conduit **8** (not shown here). In another example, the reduced pressure operation can be implemented by using a vacuum pump on that same exhaust point.

Therefore, during initialization, the vaporization section **59**, the precipitator section **26**, and other parts of the system **100** are charged with Argon gas when the rotatable precipitator electrode **38** is rotating, to pump the Argon gas around both the precipitator section **26** and the vaporization section **59**. The pressure relief valve **70** (which may be electromagnetically assisted with a control signal from the process controller **18**) is at the highest physical point in the system, and at a pressure setting that exhausts from the bypass annulus **55** through an exhaust cavity as the system **100** fills, venting off the air first (Argon gas is heavier than air). During operation at certain vapor temperatures where toxic vapors are known to exist, the Argon gas supply is activated to the bypass annulus **55** to increase pressure and therefore cause exhausting of toxic vapors through the pressure relief valve **70** and then expelled from the gas path exhaust conduit **8** (not shown here). Exhausting will also occur due to increasing pressure as the temperature ramps up between specific specified vaporization temperature set points as a result of gas expansion.

In an example embodiment, a discharge detector or electrical energy sensor **62** is used to detect a discharge and produce a signal discharge detected **54**. The tendency for electrostatic discharges as a result of avalanche effects in relatively pure Argon gas is used to detect and use the discharge detected signal **54** the completion of the vaporization process at any given temperature, where under conditions of low vapor content the electrical gap between a pair of electrical contacts set at a specific distance (not shown) will break down causing a discharge when relatively vapor free Argon is flowing into the precipitator section **26**. A discharge detector generates a control signal (the discharge detected signal **54**) to signal the process controller **18** to increment to the next specified temperature value. In some examples, the discharge detector can be an electrical energy sensor **62** such as a voltage sensor and/or a current sensor. In other examples, other sensors and controllers (not shown) are used to determine that there are no more compounds with the Argon gas, and that the heat source **19** is to proceed to the next highest specified temperature value.

In some examples, monitoring and/or controlling of the current and/or voltage of the rotatable precipitator electrode **38** can be performed by the process controller **18**. A control signal can be used by the process controller **18** to represent the vapor density as a proportional analog signal. An electrical energy sensor **62** such as a current sensor or a voltage sensor can be used in some examples to detect the current or voltage, respectively.

The Argon ionization potential as a pure gas will have a relatively low value, which will increase in the presents of vapors, and can be used to both indicate when a particular temperature vaporized compound is substantially exhausted from the feed materials, to signal the next temperature point to be processed.

In some examples, the process controller **18** can use this proportional analog signal to map the temperatures where the maximum vapor flow is obtained. In an example, the proportional analog signal is used by the process controller **18** for characterization of specific compound content of one feedstock versus a different feedstock at all temperatures used in the process.

In example embodiments, the configuration of the ionization source allows closed loop control of the current by automatic adjustment of the voltage, which allows effective measurement of the impedance of the ionization cavity, which is akin to how many common ionization type smoke detectors function. Changes in the ion current in a common smoke detector are used to detect smoke in the ion chamber, smoke particles have a higher mass than the ionized gas molecules thus when an ionized gas molecule sticks to a much more massive smoke particle the mv^2 remaining constant (proportional to temperature=$\frac{1}{2}$ mv^2, where m=Mass, v=Velocity) the Velocity of the combined particles are much slower, thus the drift current (formed by the ions flowing to the charged plates or in our case the precipitation target electrode) reaching the detector is reduced.

In this configuration, the fixed ion current is set by the process controller **18** at a non avalanche level (non arcing) with 100% Argon content (no vapor), to provide a certain specified voltage across the ionization chamber (the rotating centrifugal electrostatic precipitator **38**), which will then become a function of the ratio of Vapor/Argon, since the voltage will increase as the current tends to decrease, to hold the current constant. As the mean free particle velocity reduces due to the increase in mass in the chamber, the increase in voltage is expected to be proportional to the increase in particle mass in the chamber.

This is used for a number of potential purposes such as detecting when most of the vapor (e.g., above a threshold) has been processed at any given temperature, thus signaling the next temperature step in the process.

In some examples, the collected vapor data versus temperature is used by the process controller **18** or an external computer to determine specific grades of feedstock over time.

The specified temperature value is a fixed temperature value in some examples. In other examples, the specified temperature is a specified temperature range instead of a fixed temperature value. For example, a specified temperature range can be selected by the process controller **18** such that the minimum temperature value is the vaporization temperature of one compound of the botanical material **1** and the maximum temperature value of the temperature range is any amount that is less than the next highest vaporization temperature of the next compound in the botanical material **1**. In some example embodiments, the temperature of the vaporization section **59** can be controlled to periodically oscillate or otherwise vary within the temperature range. In some example embodiments, the temperature of the vaporization section **59** can be controlled to gradually increase form the minimum temperature value to the maximum temperature value of the temperature range, until that particular compound of the botanical material **1** is vaporized and precipitated and collected. The specified temperature value selected by the process controller **18** can also be dependent on the present pressure or an automatically controlled pressure of the vaporization section **59**. The specified temperature value may require adjustment while in the processing of vaporizing a particular compound, to account for any changes in the present pressure of the vaporization section **59**.

FIG. **10** is a perspective view of an example embodiment of a physical version of the system **100**. A touch screen **102** can be used as a user interface for outputting (displaying) information and for receiving information from the user. In some examples, the specific type of botanical material **1** is selected by way of the touch screen **102**, and the specific temperature values for specific time durations and selected from preprogrammed settings for that specific type of botanical material **1**. Other example user input devices include a remote control, mobile phone or computer application, control panel, etc. A hard button **104** or suitable switch can be used for turning on and off the entire system **100**. The drawer type cartridge **37** can have a generally rectangular prism shaped frame formed of metal, having the top containment screen **39** and the bottom containment screen **41**, and can have a handle as shown. In FIG. **10**, one drawer type cartridge **37** is shown partially inserted into the vaporization section **59**, and another drawer type cartridge **37** is shown as a spare. Each drawer type cartridge **37** can be filled on-demand by the user in some examples, and in other examples can be pre-packaged by the manufacturer. Each drawer type cartridge **37** can be recycled after use by way of cleaning and refilling. In some examples, not shown, each drawer type cartridge **37** can be automatically processed in sequence by the system **100**, wherein each drawer type cartridge **37** can be automatically inserted into the vaporization section **59**, processed to sequentially extract the each of the one or more compounds, and removed, followed by automatic insertion and processing of the next drawer type cartridge **37**. The Argon supply **20** can be stored in one or more tanks, as shown in FIG. **10**.

In some examples, the system **100** is at a small scale as a home kitchen type appliance or can be scaled up to any larger size for industrial production or processing. In some examples, the system **100** is not necessarily limited to the application described and could be applied to other botanical materials or other oil fractionation applications. The oil may be contained by materials other than botanical materials, which can be provided to the system for solvent-less vaporization, extraction, and fractionation of the oils or compounds in the same way as described above for botanical materials. Other gases besides Argon may be used for the same or different purposes.

In some examples, the process controller **18** of the system **100** can interface with the user by way of a user interface. Examples of the user interface include the touch screen **102**, display screen, microphone, speaker, buttons, keyboard or keypad. Interaction with the user can also be made using a second device, such as a mobile phone, mobile tablet, personal computer, or a home smart speaker assistant such as Amazon Echo™, Apple HomePod™, or Google Home™. A communication subsystem can be included in the system **100** to perform wireless or wired communication. The power supply **25** for the system **100** can be a battery, a DC power interface such as Universal Serial Bus (USB) and/or an A/C power converter with plug.

Other suitable liquids may be substituted for the distilled water as required or for different or additional purposes.

The exhaust gases may be further processed or filtered in a separate similar or different system for recycling or for any other purpose or reason.

In some example embodiments, the described system **100** and processes can be implemented to collect the respective one or more compounds in a batch process, for example using the drawer type cartridge **37** for each batch. In other examples, example embodiments of the described system **100** and processes can be implemented in a continuous batch process.

FIG. **15** is a flow diagram for a method **1500** of extracting botanical oils from a botanical material **1** without the use of a solvent, using the system **100** in accordance with example embodiments. In examples, the method **1500** can be controlled by the process controller **18** and/or the controller **30**. Steps of the method **1500** are sequentially performed for each one or more compounds of the botanical material **1**. At step **1502**, the method **1500** includes vaporizing, using the heat source **19** (heater), the botanical material **1** at a specified temperature value. In the sequence, each specified temperature value causes a respective vaporization temperature of the desired one or more of the compounds in the botanical material **1** to result in respective vaporized one or more compounds. At step **1504**, the method **1500** includes aerosolizing, using an inert gas (e.g. Argon gas **5**), the respective vaporized one or more compounds into respective aerosolized one or more compounds. At step **1506**, the method includes charging, using one or more of the corona electrodes **36**, the respective aerosolized one or more compounds. At step **1508**, the method includes precipitating, within an interior of the rotatable precipitator electrode **38** (comprising a frame having a metal screen), the respective charged aerosolized one or more compounds into respective precipitated one or more compounds, by rotating the frame using the motor **28**. At step **1510**, the method includes collecting, using the collection system **29**, the respective precipitated one or more compounds that are externally centrifugally expelled from the rotatable precipitator electrode **38** when the rotatable precipitator electrode **38** is rotated. At step **1512**, the steps of the method **1500** are repeated for the next one or more compounds in the botanical material **1**. The method **1500** is repeated until all of the compounds in the botanical material **1** are processed, or other suitable automated, sensed, or controlled events. In some examples, at step **1514**, the method **1500** includes bypassing the processing of unwanted one or more vaporized compounds within the sequence by exhausting the unwanted one or more vaporized compounds from an exhaust outlet (e.g. the bypass annulus **55** and associated exhaust cavity). Such unwanted one or more vaporized compounds are not aerosolized, charged, precipitated or collected.

An example embodiment is a system for extracting compounds from botanical material, comprising: a heater for sequentially vaporizing the botanical material at specified temperature values, each specified temperature value causing a respective vaporization temperature of one or more of the compounds in the botanical material to result in respective vaporized one or more compounds; a gas inlet for receiving an inert gas, the inert gas being for sequentially aerosolizing each of the respective vaporized one or more compounds into respective aerosolized one or more compounds; a corona electrode for sequentially charging each of the respective aerosolized one or more compounds; an electrostatic precipitator including a frame having a metal screen and the metal screen defines an interior for receiving and sequentially precipitating each of the respective charged aerosolized one or more compounds into respective precipitated one or more compounds, a motor for controlling rotation the frame having the metal screen around an axis of rotation to perform said precipitating; and a collection system at least part of which is positioned radially exterior from the frame having the metal screen with respect to the axis of rotation, the collection system for sequentially collecting each of the respective precipitated one or more compounds for each specified temperature value that are externally centrifugally expelled from the frame having the metal screen when the frame is rotated.

In an example embodiment, the inert gas is Argon gas.

In an example embodiment, the inert gas is unheated when introduced for the aerosolizing of each of the respective vaporized one or more compounds.

In an example embodiment, the system further comprises a second gas inlet for introducing a second inert gas to the botanical material during the vaporizing of the botanical material.

In an example embodiment, the second inert gas and the second gas inlet are heated by the heater to a temperature that is greater than each respective specified temperature value of the respective one or more compounds.

In an example embodiment, the system further comprises one or more temperature sensors for detecting temperature of the respective vaporized one or more compounds, wherein the heater is controlled to, based on the detected temperature, heat the second gas inlet and the second inert gas to achieve the temperature that is greater than each respective specified temperature value of the respective one or more compounds.

In an example embodiment, the system further comprises a pressure regulator for pressurizing the second inert gas prior to the introducing to the botanical material.

In an example embodiment, the second inert gas is Argon gas.

In an example embodiment, the vaporizing of the botanical material is performed without a liquid solvent or liquid solvents.

In an example embodiment, the precipitating of the respective charged aerosolized one or more compounds is performed without a liquid solvent or liquid solvents.

In an example embodiment, the system further comprises an activatable bypass for removing unwanted vaporized one or more compounds that are vaporized by the heater without the aerosolizing and without the precipitating.

In an example embodiment, flow of the inert gas, the corona electrode, and/or the motor are deactivated when the activatable bypass is activated.

In an example embodiment, the removing by the bypass is controlled to be performed without the receiving by the interior of the frame.

In an example embodiment, the activatable bypass is controlled to be activated at one or more specified temperature values, at 0.05 mmHg, of i) less than 52 Degrees C., or ii) greater than 180 Degrees C., or iii) on or about 110.6 Degrees C. for Toluene, or any of i), ii), or iii) adjusted for present pressure as compared to 0.05 mmHg.

In an example embodiment, the system further comprises a pressure relief valve for limiting a maximum pressure of a pressure of the system.

In an example embodiment, the pressure relief valve is configured for removing unwanted contaminants or vaporized one or more compounds that are vaporized by the heater.

In an example embodiment, the inert gas is controlled to be inserted through the gas inlet or a second gas inlet to cause activation of the pressure relief valve.

In an example embodiment, the system further comprises a circuit for recirculating the inert gas that are externally centrifugally expelled from the frame having the metal screen and having the one or more compounds electrostatically cleaned from the inert gas by the electrostatic precipitator.

In an example embodiment, the system further comprises one or more paddle type vanes at the electrostatic precipitator which rotate from control by the motor for facilitating the recirculating of the inert gas.

In an example embodiment, each specified temperature value is a specified fixed temperature value.

In an example embodiment, each specified temperature value is a specified range of temperature values.

In an example embodiment, each specified range of temperature values has a minimum temperature value which is a minimum respective vaporization temperature of the respective one or more of the compounds and has a maximum temperature value which is less than the respective vaporization temperature of a next highest vaporization temperature of a next one or more compounds in the botanical material.

In an example embodiment, the collection system comprises a removable sleeve for adsorbing the respective precipitated one or more compounds.

In an example embodiment, the collection system comprises a movable belt of material for adsorbing the respective precipitated one or more compounds.

In an example embodiment, the collection system further comprises: a rotatable sleeve positioned radially exterior from the frame having the metal screen with respect to the axis of rotation, the rotatable sleeve rotatable along the axis of rotation, the rotatable sleeve having a first end and an opposite second end generally across the axis of rotation; and a conduit for flow of a fluid that flows from the first end of the rotatable sleeve to the second end of the rotatable sleeve for transporting the respective precipitated one or more compounds.

In an example embodiment, the rotatable sleeve is mounted to the motor.

In an example embodiment, the collection system further comprises a conveyor and collection vessels supported by the conveyor, each collection vessel for individually collecting each of the respective precipitated one or more compounds with the fluid.

In an example embodiment, the fluid is distilled water.

In an example embodiment, the metal screen defines apertures of a size to permit passage of the respective precipitated one or more compounds.

In an example embodiment, the metal screen includes an interior metal screen having a fine metal mesh and an exterior metal screen having a coarse metal mesh as compared to the fine metal mesh.

In an example embodiment, the frame having the metal screen is generally cylindrical.

In an example embodiment, the axis of rotation is generally horizontal and an opening to the interior of the frame having the metal screen is defined at one lateral side of the frame for the receiving of each of the respective charged aerosolized one or more compounds.

In an example embodiment, the system further comprises a circuit for recirculating the inert gas from the frame having the metal screen, the inert gas being recirculated to the gas inlet.

In an example embodiment, the heater causes each of the specified temperature values in an increasing sequential order.

In an example embodiment, the system further comprises a detector for determining presence of the inert gas without any of the one or more compounds, and in response the heater is controlled to achieve a next specified vaporization temperature of a next one or more compounds in the botanical material.

In an example embodiment, the system further comprises a discharge detector for detecting a discharge resulting from presence of the inert gas without any of the one or more compounds or below a threshold of the one or more compounds, and in response the heater is controlled to achieve a next specified vaporization temperature of a next one or more compounds in the botanical material.

In an example embodiment, the system further comprises a cartridge including sidewalls for containing the botanical material, at least one of the walls comprising a screen for permitting output of the respective vaporized one or more compounds.

In an example embodiment, the botanical material comprises milled botanical material.

In an example embodiment, the botanical material comprises *cannabis* botanical material.

In an example embodiment, any one of the specified temperature values comprises any one of, at 0.05 mmHg:
52 Degrees C. for vaporizing Cannabigerol (CBG), or
119 Degrees C. for vaporizingg Beta-Caryophyllene, or
134 Degrees C. for vaporizing Beta-Siteosterol, or
157 Degrees C. for vaporizingg Delta-9-Tetrahydrocannabinol (THC), or
anywhere in a range of 160-180 Degrees C. for vaporizing Cannabidiol (CBD); or
wherein any one of the specified temperature values comprises any of the above specified temperature values at 0.05 mmHg adjusted for present pressure as compared to 0.05 mmHg.

In an example embodiment, the specified temperature values comprise the following at 0.05 mmHg, or adjusted for present pressure as compared to 0.05 mmHg, in sequence for the sequentially vaporizing:

52 Degrees C. for vaporizing Cannabigerol (CBG),
119 Degrees C. for vaporizing Beta-Caryophyllene,
134 Degrees C. for vaporizing Beta-Siteosterol,
157 Degrees C. for vaporizing Delta-9-Tetrahydrocannabinol (THC), and
anywhere in a range of 160-180 Degrees C. for vaporizing Cannabidiol (CBD).

In an example embodiment, the system further comprises at least one controller for controlling the heater, flow of the inert gas, the corona electrode, the motor, and the collection system.

In an example embodiment, the system is configured to collect each respective one or more compounds in a batch process.

In an example embodiment, the collection system is controlled to individually collect each of the respective precipitated one or more compounds for each specified temperature value.

In an example embodiment, the system further comprises a sensor used to determine conductivity due to an amount of the inert gas versus the respective aerosolized one or more compounds, wherein when the determined conductivity indicates that there is not any of the respective aerosolized one or more compounds or below a threshold amount of the respective aerosolized one or more compounds, the heater is controlled to achieve a next specified vaporization temperature of a next one or more compounds in the botanical material.

In an example embodiment, when the metal screen is performing the precipitating, the metal screen is grounded, or controlled to be at zero volts, or controlled to be at a voltage that is different than a charge provided by the corona electrode.

An example embodiment is method for extracting compounds from botanical material, comprising: sequentially vaporizing, using a heater, the botanical material at specified temperature values, each specified temperature value causing a respective vaporization temperature of one or more of the compounds in the botanical material to result in respective vaporized one or more compounds; for each of the vaporized one or more compounds from each specified temperature value: aerosolizing, using an inert gas, the respective vaporized one or more compounds into respective aerosolized one or more compounds, charging, using a corona electrode, the respective aerosolized one or more compounds, precipitating, within an interior of a metal screen of a frame, the respective charged aerosolized one or more compounds into respective precipitated one or more compounds, by rotating the frame using a motor, and collecting the respective precipitated one or more compounds that are externally centrifugally expelled from the frame having the metal screen when the frame is rotated.

In example embodiments, as appropriate, each illustrated block or module may be combined in some example embodiments, and more or less blocks or modules may be present in other example embodiments. Furthermore, some of the blocks or modules may be separated into a number of sub-blocks or sub-modules in other embodiments.

While some of the present embodiments are described in terms of methods, a person of ordinary skill in the art will understand that present embodiments are also directed to various apparatus such as a device or system including components for performing at least some of the aspects and features of the described methods, be it by way of hardware components, software or any combination of the two, or in any other manner. Moreover, an article of manufacture for use with the apparatus, such as a pre-recorded storage device or other similar non-transitory computer readable medium including program instructions recorded thereon, or a computer data signal carrying computer readable program instructions may direct an apparatus to facilitate the practice of the described methods. It is understood that such apparatus, articles of manufacture, and computer data signals also come within the scope of the present example embodiments.

While some of the above examples have been described as occurring in a particular order, it will be appreciated to persons skilled in the art that some of the messages or steps or processes may be performed in a different order provided that the result of the changed order of any given step will not prevent or impair the occurrence of subsequent steps. Furthermore, some of the messages or steps described above may be removed or combined in other embodiments, and some of the messages or steps described above may be separated into a number of sub-messages or sub-steps in other embodiments. Even further, some or all of the steps of the conversations may be repeated, as necessary. Elements described as methods or steps similarly apply to systems or subcomponents, and vice-versa.

In example embodiments, the one or more controllers can be implemented by or executed by, for example, one or more of the following systems: Personal Computer (PC), Programmable Logic Controller (PLC), microprocessor, cloud computing, server (local or remote), mobile phone or mobile communication device.

The term "computer readable medium" as used herein includes any medium which can store instructions, program steps, or the like, for use by or execution by a computer or other computing device including, but not limited to: magnetic media, such as a diskette, a disk drive, a magnetic drum, a magneto-optical disk, a magnetic tape, a magnetic core memory, or the like; electronic storage, such as a random access memory (RAM) of any type including static RAM, dynamic RAM, synchronous dynamic RAM (SDRAM), a read-only memory (ROM), a programmable-read-only memory of any type including PROM, EPROM, EEPROM, FLASH, EAROM, a so-called "solid state disk", other electronic storage of any type including a charge-coupled device (CCD), or magnetic bubble memory, a portable electronic data-carrying card of any type including COMPACT FLASH, SECURE DIGITAL (SD-CARD), MEMORY STICK, and the like; and optical media such as a Compact Disc (CD), Digital Versatile Disc (DVD) or BLU-RAY® Disc.

Variations may be made to some example embodiments, which may include combinations and sub-combinations of any of the above. The various embodiments presented above are merely examples and are in no way meant to limit the scope of this disclosure. Variations of the innovations described herein will be apparent to persons of ordinary skill in the art having the benefit of the present disclosure, such variations being within the intended scope of the present disclosure. In particular, features from one or more of the above-described embodiments may be selected to create alternative embodiments comprised of a sub-combination of features which may not be explicitly described above. In addition, features from one or more of the above-described embodiments may be selected and combined to create alternative embodiments comprised of a combination of features which may not be explicitly described above. Features suitable for such combinations and sub-combinations would be readily apparent to persons skilled in the art upon review of the present disclosure as a whole. The subject matter described herein intends to cover and embrace all suitable changes in technology.

Certain adaptations and modifications of the described embodiments can be made. Therefore, the above discussed embodiments are considered to be illustrative and not restrictive.

NUMERICAL DESIGNATIONS

Numerical Designations:
1 Botanical material
2 Gas inlet
3 Regulated Argon gas
4 High pressure Argon gas
5 Argon gas
6 Exit vapor (hot oil vapor and hot Argon)
7 Aerosolized oil and Argon
8 Gas path exhaust conduit
9 Centrifugal rotational drive
10 Drive motor control signal
11 Electrostatic power supply
12 Liquid oil droplets
13 Control signal
14 Temperature (First section vapor exit temperature)
15 Control signal
16 Distributor control
18 Process controller
19 Heat Source
20 Argon supply
21 Argon pressure regulator
22 Argon gas
23 Solenoid valve
24 Mixer section
25 Power supply
26 Precipitator section
27 Motor drive control
28 Motor
29 Collection system
30 Controller
31 Fluid supply
32 Annular fluid conduit
33 Collection vessel indexing system
34 Product
35 Separated product
36 Corona electrodes
37 Cartridge
38 Rotatable precipitator electrode
39 Upper containment screen
40 Support system
41 Lower containment screen
42 Semi-sealed oven enclosure
43 Heater control
44 Removable sleeve
45 Belt support sleeve
46 Moveable belt
47 Rotatable sleeve
48 Distilled water or other fluid film
49 Distilled water or other fluid plus compound
50 Conduit
51 Drain conduit
52 Collection vessel
53 Bypass duct
54 Discharge detected signal
55 Vapor bypass intake annulus
58 Conveyor
59 Vaporization section
60 Centrifugal electrostatic precipitator
62 Electrical energy Sensor
64 Temperature Sensor
66 Recirculation conduit
68 Tangential gas duct
70 Pressure Relief Valve
72 Paddle type vane
74 Mount
76 Vane
80 Heat sink tube
100 System
102 Touch screen
104 Hard button

What is claimed is:

1. A system for extracting compounds from botanical material, comprising:

a heater for sequentially vaporizing the botanical material at specified temperature values, each specified temperature value causing a respective vaporization temperature of one or more of the compounds in the botanical material to result in respective vaporized one or more compounds;

a gas inlet for receiving an inert gas, the inert gas being for sequentially aerosolizing each of the respective vaporized one or more compounds into respective aerosolized one or more compounds;

a corona electrode for sequentially charging each of the respective aerosolized one or more compounds;

an electrostatic precipitator including a frame which defines an interior for receiving and sequentially precipitating each of the respective charged aerosolized one or more compounds into respective precipitated one or more compounds, an axis of rotation central to the frame, a motor for controlling rotation of the frame around the axis of rotation to perform said precipitating; and

a collection system at least part of which is positioned radially exterior from the frame with respect to the axis of rotation, the collection system for sequentially collecting each of the respective precipitated one or more compounds for each specified temperature value that are externally centrifugally expelled from the frame when the frame is rotated.

2. The system as claimed in claim **1**, wherein the inert gas is Argon gas.

3. The system as claimed in claim **1**, wherein the inert gas is unheated when introduced for the aerosolizing of each of the respective vaporized one or more compounds.

4. The system as claimed in claim **1**, further comprising a second gas inlet for introducing a second inert gas to the botanical material during the vaporizing of the botanical material.

5. The system as claimed in claim **4**, wherein the second inert gas and the second gas inlet are heated by the heater to a temperature that is greater than each respective specified temperature value of the respective one or more compounds.

6. The system as claimed in claim **4**, further comprising one or more temperature sensors for detecting temperature of the respective vaporized one or more compounds, wherein the heater is controlled to heat, based on the detected temperature, the second gas inlet and the second inert gas to achieve the temperature that is greater than each respective specified temperature value of the respective one or more compounds.

7. The system as claimed in claim **4**, further comprising a pressure regulator for pressurizing the second inert gas prior to the introducing to the botanical material.

8. The system as claimed in claim **4**, wherein the second inert gas is Argon gas.

9. The system as claimed in claim **1**, wherein the vaporizing of the botanical material is performed without a liquid solvent or liquid solvents.

10. The system as claimed in claim **1**, wherein the precipitating of the respective charged aerosolized one or more compounds is performed without a liquid solvent or liquid solvents.

11. The system as claimed in claim **1**, further comprising an activatable bypass for removing unwanted vaporized one or more compounds that are vaporized by the heater without the aerosolizing and without the precipitating.

12. The system as claimed in claim **11**, wherein flow of the inert gas, the corona electrode, and/or the motor are deactivated when the activatable bypass is activated.

13. The system as claimed in claim **11**, wherein the removing by the bypass is controlled to be performed without the receiving by the interior of the frame.

14. The system as claimed in claim **11**, wherein the activatable bypass is controlled to be activated at one or more specified temperature values of i) less than 52 Degrees C., or ii) greater than 180 Degrees C., or iii) on or about 110.6 Degrees C. for Toluene.

15. The system as claimed in claim **1**, further comprising a pressure relief valve for limiting a maximum pressure of a pressure of the system.

16. The system as claimed in claim **15**, wherein the pressure relief valve is configured for removing unwanted contaminants or vaporized one or more compounds that are vaporized by the heater.

17. The system as claimed in claim **16**, wherein the inert gas is controlled to be inserted through the gas inlet or a second gas inlet to cause activation of the pressure relief valve.

18. The system as claimed in claim **1**, further comprising a circuit for recirculating the inert gas that are externally centrifugally expelled from the frame and having the one or more compounds electrostatically cleaned from the inert gas by the electrostatic precipitator.

19. The system as claimed in claim **18**, further comprising one or more paddle type vanes at the electrostatic precipitator which rotate from control by the motor for facilitating the recirculating of the inert gas.

20. The system as claimed in claim **1**, wherein each specified temperature value is a specified fixed temperature value.

21. The system as claimed in claim **1**, wherein each specified temperature value is a specified range of temperature values.

22. The system as claimed in claim **21**, wherein each specified range of temperature values has a minimum temperature value which is a minimum respective vaporization temperature of the respective one or more of the compounds and has a maximum temperature value which is less than the respective vaporization temperature of a next highest vaporization temperature of a next one or more compounds in the botanical material.

23. The system as claimed in claim **1**, wherein the collection system comprises a removable sleeve for adsorbing the respective precipitated one or more compounds.

24. The system as claimed in claim **1**, wherein the collection system comprises a movable belt of material for adsorbing the respective precipitated one or more compounds.

25. The system as claimed in claim **1**, wherein the collection system further comprises:

a conduit for flow of a fluid for transporting the respective precipitated one or more compounds.

26. The system as claimed in claim **25**, wherein the collection system further comprises a rotatable sleeve positioned radially exterior from the frame with respect to the axis of rotation, the rotatable sleeve rotatable along the axis of rotation, the rotatable sleeve having a first end and an opposite second end generally across the axis of rotation, wherein the fluid flows from the first end of the rotatable sleeve to the second end of the rotatable sleeve.

27. The system as claimed in claim **25**, wherein the collection system further comprises a conveyor and collection vessels supported by the conveyor, each collection vessel for individually collecting each of the respective precipitated one or more compounds with the fluid.

28. The system as claimed in claim **25**, wherein the fluid is distilled water.

29. The system as claimed in claim **1**, wherein the frame has a metal screen, wherein the metal screen defines apertures of a size to permit passage of the respective precipitated one or more compounds.

30. The system as claimed in claim **1**, wherein the frame has a metal screen, wherein the metal screen includes an interior metal screen having a fine metal mesh and an exterior metal screen having a coarse metal mesh as compared to the fine metal mesh.

31. The system as claimed in claim **1**, wherein the frame is generally cylindrical.

32. The system as claimed in claim **1**, wherein the axis of rotation is generally horizontal and an opening to the interior of the frame is defined at one lateral side of the frame for the receiving of each of the respective charged aerosolized one or more compounds.

33. The system as claimed in claim **1**, further comprising a circuit for recirculating the inert gas from the frame, the inert gas being recirculated to the gas inlet.

34. The system as claimed in claim **1**, wherein the heater causes each of the specified temperature values in an increasing sequential order.

35. The system as claimed in claim **1**, further comprising a detector for determining presence of the inert gas without any of the one or more compounds, and in response the heater is controlled to achieve a next specified vaporization temperature of a next one or more compounds in the botanical material.

36. The system as claimed in claim **1**, further comprising a discharge detector for detecting a discharge resulting from presence of the inert gas without any of the one or more compounds or below a threshold of the one or more compounds, and in response the heater is controlled to achieve a next specified vaporization temperature of a next one or more compounds in the botanical material.

37. The system as claimed in claim **1**, further comprising a cartridge including sidewalls for containing the botanical material, at least one of the walls comprising a screen for permitting output of the respective vaporized one or more compounds.

38. The system as claimed in claim **1**, wherein the botanical material comprises milled botanical material.

39. The system as claimed in claim **1**, wherein the botanical material comprises *cannabis* botanical material.

40. The system as claimed in claim **39**, wherein any one of the specified temperature values comprises any one of:

52 Degrees C. for vaporizing Cannabigerol (CBG), or
119 Degrees C. for vaporizing Beta-Caryophyllene, or
134 Degrees C. for vaporizing Beta-Siteosterol, or

157 Degrees C. for vaporizing Delta-9-Tetrahydrocannabinol (THC), or

anywhere in a range of 160-180 Degrees C. for vaporizing Cannabidiol (CBD).

41. The system as claimed in claim **39**, wherein the specified temperature values comprise the following in sequence for the sequentially vaporizing:

52 Degrees C. for vaporizing Cannabigerol (CBG),

119 Degrees C. for vaporizing Beta-Caryophyllene,

134 Degrees C. for vaporizing Beta-Siteosterol,

157 Degrees C. for vaporizing Delta-9-Tetrahydrocannabinol (THC), and

anywhere in a range of 160-180 Degrees C. for vaporizing Cannabidiol (CBD).

42. The system as claimed in claim **1**, further comprising at least one controller for controlling the heater, flow of the inert gas, the corona electrode, the motor, and the collection system.

43. The system as claimed in claim **1**, wherein the system is configured to collect each respective one or more compounds in a batch process.

44. The system as claimed in claim **1**, wherein the collection system is controlled to individually collect each of the respective precipitated one or more compounds for each specified temperature value.

45. The system as claimed in claim **1**, further comprising a sensor used to determine conductivity due to an amount of the inert gas versus the respective aerosolized one or more compounds, wherein when the determined conductivity indicates that there is not any of the respective aerosolized one or more compounds or below a threshold amount of the respective aerosolized one or more compounds, the heater is controlled to achieve a next specified vaporization temperature of a next one or more compounds in the botanical material.

46. The system as claimed in claim **1**, wherein the frame has metal, wherein when the frame is performing the precipitating, the metal is grounded, or controlled to be at zero volts, or controlled to be at a voltage that is different than a charge provided by the corona electrode.

47. The system as claimed in claim **1**, wherein the collection system further comprises collection vessels, each collection vessel for individually collecting each of the respective precipitated one or more compounds.

48. The system as claimed in claim **26**, wherein the rotatable sleeve is mounted to the motor.

49. The system as claimed in claim **1**, wherein the collection system further comprises one or more collection vessels for collecting the precipitated one or more compounds, wherein one of the collection vessels is for collecting at least two of the respective precipitated one or more compounds.

50. A system for extracting compounds from botanical material, comprising:

a heater for sequentially vaporizing the botanical material at specified temperature values, each specified temperature value causing a respective vaporization temperature of one or more of the compounds in the botanical material to result in respective vaporized one or more compounds;

a gas inlet for receiving an inert gas, the inert gas being for sequentially aerosolizing each of the respective vaporized one or more compounds into respective aerosolized one or more compounds;

a corona electrode for sequentially charging each of the respective aerosolized one or more compounds;

an electrostatic precipitator including a frame which defines an interior for receiving and sequentially precipitating each of the respective charged aerosolized one or more compounds into respective precipitated one or more compounds, an axis of rotation central to the frame, a motor for controlling rotation of the frame around the axis of rotation to perform said precipitating; and

a collection system at least part of which is positioned radially exterior from the frame with respect to the axis of rotation, the collection system for sequentially collecting each of the respective precipitated one or more compounds for each specified temperature value that are externally centrifugally expelled from the frame when the frame is rotated,

wherein the frame has a metal screen, wherein the metal screen defines apertures of a size to permit passage of the respective precipitated one or more compounds.

51. A system for extracting compounds from botanical material, comprising:

a heater for sequentially vaporizing the botanical material at specified temperature values, each specified temperature value causing a respective vaporization temperature of one or more of the compounds in the botanical material to result in respective vaporized one or more compounds;

a gas inlet for receiving an inert gas, the inert gas being for sequentially aerosolizing each of the respective vaporized one or more compounds into respective aerosolized one or more compounds;

a corona electrode for sequentially charging each of the respective aerosolized one or more compounds;

an electrostatic precipitator including a frame which defines an interior for receiving and sequentially precipitating each of the respective charged aerosolized one or more compounds into respective precipitated one or more compounds, an axis of rotation central to the frame, a motor for controlling rotation of the frame around the axis of rotation to perform said precipitating; and

a collection system at least part of which is positioned radially exterior from the frame with respect to the axis of rotation, the collection system for sequentially collecting each of the respective precipitated one or more compounds for each specified temperature value that are externally centrifugally expelled from the frame when the frame is rotated,

wherein the frame has a metal screen, wherein the metal screen includes an interior metal screen having a fine metal mesh and an exterior metal screen having a coarse metal mesh as compared to the fine metal mesh.

52. A system for extracting compounds from botanical material, comprising:

a heater for sequentially vaporizing the botanical material at specified temperature values, each specified temperature value causing a respective vaporization temperature of one or more of the compounds in the botanical material to result in respective vaporized one or more compounds;

a gas inlet for receiving an inert gas, the inert gas being for sequentially aerosolizing each of the respective vaporized one or more compounds into respective aerosolized one or more compounds;

a corona electrode for sequentially charging each of the respective aerosolized one or more compounds;

an electrostatic precipitator including a frame which defines an interior for receiving and sequentially precipitating each of the respective charged aerosolized one or more compounds into respective precipitated one or more compounds, an axis of rotation central to the frame, a motor for controlling rotation of the frame around the axis of rotation to perform said precipitating; and

a collection system at least part of which is positioned radially exterior from the frame with respect to the axis of rotation, the collection system for sequentially collecting each of the respective precipitated one or more compounds for each specified temperature value that are externally centrifugally expelled from the frame when the frame is rotated,

wherein the collection system further comprises:

a conduit for flow of a fluid for transporting the respective precipitated one or more compounds, and

a rotatable sleeve positioned radially exterior from the frame with respect to the axis of rotation, the rotatable sleeve rotatable along the axis of rotation, the rotatable sleeve having a first end and an opposite second end generally across the axis of rotation,

wherein the fluid flows from the first end of the rotatable sleeve to the second end of the rotatable sleeve.

53. The system as claimed in claim **52**, wherein the rotatable sleeve is mounted to the motor.

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